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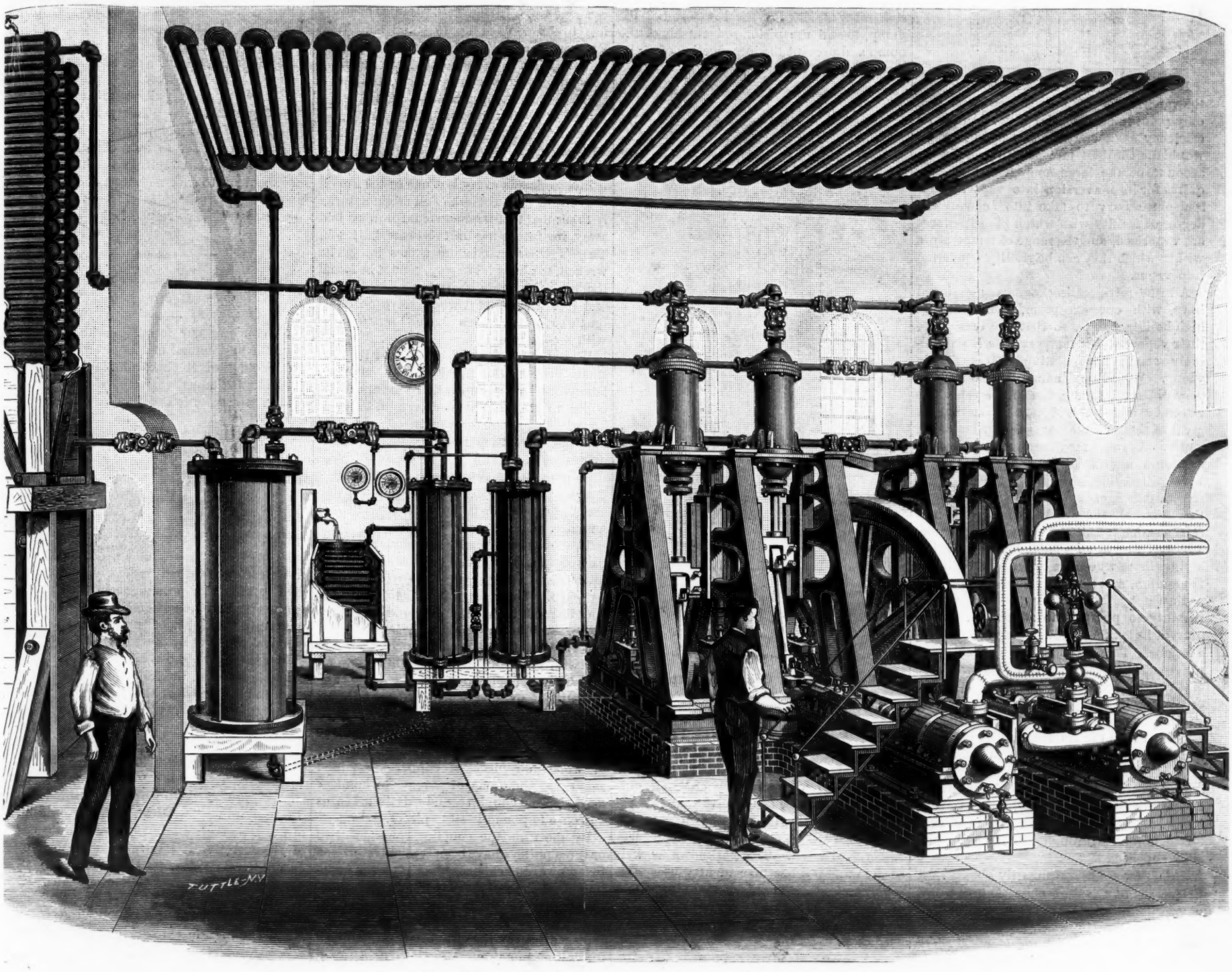


NEW REFRIGERATING APPARATUS AT HERMAN BREWERY.

The De LaVergne and Mixer Refrigerating Machine.

Among other important subjects to which the attention of practical mechanics and inventors has of late been drawn, is that of the absorption of heat and the artificial production of ice. The principles of ice making and refrigeration by such means had long been familiar to many of the readers of technical journals, at least, to that extent to which the science had advanced; but in this, as in other branches, much has remained to be accomplished. Some of the principal obstacles to the successful prosecution of the undertaking has been the large expense necessary to a proper investigation of the subject and the development of a practical apparatus, or, of such an apparatus as could be readily managed by those in whose hands it would be likely to be placed, and so constructed that it should be subject to no greater wear than that of other machinery, where the same amount of power is employed, at the same time be capable of refrigerating and producing ice at a cost that would warrant its introduction for general use.

Among those who have been experimenting with this object in view, it has been universally conceded, of the volatile gases, that of ammonia is the most profitable to employ for the purpose, in consequence of its low boiling point (30° Fah.), its great tension and capacity for the absorption of heat.

While fully recognizing these important advantages, manufacturers have hitherto failed to handle the gas very successfully, owing to the imperfect construction of their vacuum and compression pumps, imperfect joints, the leakage of gas past the piston and piston rod, the heating of the pump, and the excessive increase of friction and enormous consumption of power, owing to the lack of a proper system of lubricating the internal operating parts of the compressor, and other mechanical difficulties which presented themselves.

The high price of ice and its enormous consumption has served as a stimulant to further effort, and we now present to our readers, upon the first page, a cut of a machine which has been in constant use day and night during the past season at the brewery of Messrs. De La Vergne and Burr, 221 West 18th street, New York City. This machine is claimed to be free from the objections specified.

Refrigerating machines are usually divided into three classes: absorption, compression and vacuum machines. This is a compression machine.

The refrigerating agent used is ammoniacal gas, though other gases may be used. Ammonia, however, is preferred on account of its great refrigerating power. Annexed is a table giving the necessary data to enable the reader to form his own conclusions as to the relative refrigerating power of each of the substances named:

Names of Substances.	Boiling Point.	Pressure of Vapor in lbs. per square inch at 0° Fah.	15 lbs. Atmospheric Pressure. Pressure of Vapor in lbs. per square inch at 32° Fah.	15 lbs. Atmospheric Pressure. Pressure of Vapor in lbs. per square inch at 65° Fah.	Latent Heat.
Ammonia.....	−30°	37.8	66.5	135.	900. Heat Units.
Sulphurous Oxide....	+14°	10.8	22.95	60.	175. Heat Units.
Ether.....	+90°		3.6	8.	162. Heat Units.
Chymogene.....	+40°			14.	170. Heat Units.
Water.....	212°		.09	0.3	990. Heat Units.

If the amount of heat rendered latent by the vaporization of a substance were the only point to be considered, in regard to its efficiency as a refrigerating agent, water would be the best material to employ on account of the large amount of heat it requires for its conversion into vapor, but it is also necessary to take into account the degree of facility with which the substances are vaporized, and the range of temperature within which they can be readily converted into vapor.

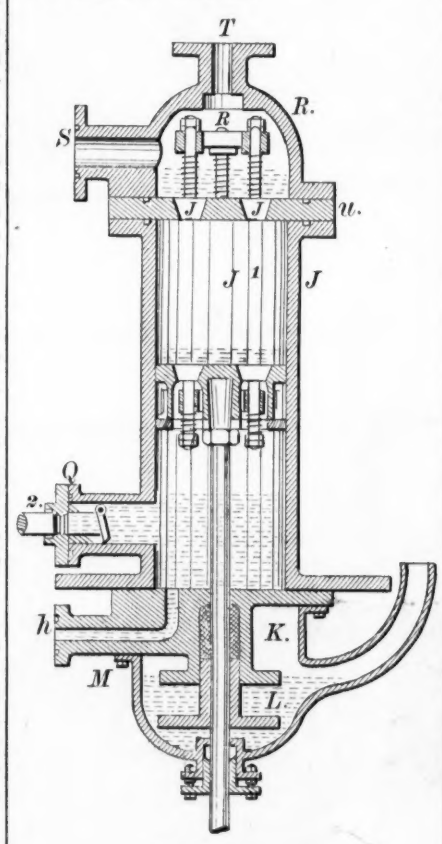
All the refrigerating agents mentioned have, with one exception, comparatively high boiling points, so that the tension of their vapors at low temperatures is exceedingly small, necessitating evaporation in vacuo. With liquid ammonia the case is very different, the tension of its vapor between 60° and —4° is about eighteen times as great as that of ether or sulphurous oxide vapor. At the same time the latent heat of ammonia approaches very nearly that of water, it being the greatest of all refrigerating agents known. It possesses, therefore, all the qualities necessary in a refrigerating agent in a very high degree. This has always been conceded by scientists and by those who have experimented in refrigeration, and the only argument advanced against it by interested opponents is their inability to pump it to advantage, and to prevent its leaking through the points or connections. These difficulties (which were purely mechanical), it is claimed, have been entirely overcome by Messrs. De La Vergne & Mixer. In the apparatus at the Herman Brewery about six miles of pipe are attached and filled with the ammonia under pressure, and not a single leak is found to exist anywhere.

The great power of the machine is due to the peculiar construction of the compressors, being such that all the gas taken in at each stroke is forced through, and none can possibly slip back.

This brewery uses ordinarily about 7,000 tons of ice in a year, or about 30 tons a day, during the heated term. The machine now cools the entire brewery, no ice being required and none kept on storage. The brewery proprietors depend entirely on the machine for cooling all the cellars, ice houses and fermenting rooms (about 178,000 cubic feet), with over four (4) miles of frosted pipe.

The machine is (as shown in the cut) quadruplexed, and so constructed that one compression pump, or all four, may be run at once. Two of the compressors are found to be amply sufficient to do all the cooling required, so there need be no stopping for cleaning or repairs. The apparatus is also provided with a double condenser for the same reason.

A section of the compression pump is shown on page 2, exhibiting the manner of sealing the piston rod and internal operating parts of the pump; the lubricating material is injected upon the downward stroke of the piston by an auxiliary-pump, after the cylinder has received its full complement of the refrigerating agent. The lubricant is kept in constant circulation and is cooled after its ejection from the pump. It is separated from the refrigerating agent before its re-introduction, that it may be re-introduced in determined quantities, and the capacity of the pump for supplying gas be not diminished. *J* is the pump cylinder, *U* the diaphragm, *R* the domed chamber above the diaphragm, with outlets *T* and *S*, through which the gas and lubricant are discharged. The liquid above the diaphragm shows the manner of sealing the valves *J*, therein; the liquid upon the piston serves to seal the piston while compressing the gas; that below the piston seals the piston rod while the piston is submerged to obtain a fresh supply of the lubricant prior to its upward stroke—this is received into said cylinder through the passage *h*, upon the downward stroke of the piston and after the reception of a full complement of gas through the pipe *Q*. *k* is a chamber attached to the lower end of the pump, to seal the piston rod outside of the pump and prevent the introduction of air by the working of the pump.



Extracts from Chordal's Letters.

Mr. Editor:

* * * * In my last letter I quoted a remark of Sackett to the effect that now-a-days no sane man thinks of fitting up a new line shaft job with anything but split pulleys. I am disposed to believe that this remark of Sackett's, like most such remarks, is intended to express a sense of correctness rather than a fact. Sackett knows as well as I do that not one man in fifty uses split pulleys at all. The fact that forty-nine men don't use them does not indicate that it would not be good policy for them to be used more.

* * * * My own opinion is that the split pulley is a good institution. Their first cost is a trifle more than a solid pulley, and they are not as handsome, but the cost in the end will be found to be less than solid pulleys, and a sort of "functional beauty" should result from the apparent propriety of the thing.

* * * * I know that all well regulated machine shops have excellent intentions of making all pulley changes, etc., at night or at noon, so as not to interfere with work. Such good intentions are like many other good intentions around machine shops, that is, they don't amount to much. There is hardly a shop in the land which don't stop in the middle of a day's work, time after time during the year, to do some fussing with line shaft pulleys.

* * * * If a twenty-inch pulley has to be put on a shaft in a small shop working, say, ten men, the whole thing don't hesitate to come to a stand-still while the change is being made. Every man from proprietor down to cub is under the impression that he is doing something on the job himself, and, as a consequence, the job must be charged with the total machine shop labor and expense bill for about five hours. The more men there are, the longer it takes to do the work.

It looks like a short and simple piece of work to stop a line shaft, unbolt couplings, loosen collars, move part of the shaft endwise, worry one of the couplings off, get three or four pulleys off, put the new pulley on, put the old ones back, worry the coupling on again, move the shaft back, put in the coupling bolts, tighten up collars and pulley screws, and start the machine again. It's mighty easy and cheap to tell about it, but it takes a long time, and costs lots of money.

* * * * In the first place, something has to be cobbled up to stand on. Who ever saw a nice line shaft trestle around a shop? Then it is found that the coupling nuts are let into counter seats, and that a special wrench must be had. Question:—"Shall we wait for a wrench to be forged, or shall we get the nuts off with a chisel?" Answer by all—"O! get a good wrench made." The wrench is ordered, and while it is being made every last one of the nuts is hogged off with a chisel. You might naturally think that this wrench would now be laid away for future use on this same shaft job. There's where a mistake comes in. The wrench, so nicely laid away, cannot be found the next time this shaft is tinkered with, and if it was found it would have no effect on these nuts which have been foliated with a cold chisel.

When the nuts are off it is found that the smart genius who fitted up the coupling labored under the impression that the bolts ought to fit the holes—driven in oil you know. They were driven in oil. If they had not been they never could have been driven at all. The job now is to drive them out in oil. While one man goes for a chunk of copper, the man who ordered the copper proceeds to batter them out with his hammer.

The bolts are finally out and the shaft backed open a foot or so, after about a dozen interfering pulleys are hunted out and loosened. The next thing is to unkey the coupling. It is the case of the wrench over again. While the blacksmith is forging a special drift, the head man is pecking at the key with every old drift and chisel around the place, and gets the small end of the key so battered up that when the special drift is done there is a double quantity of work for it to do. When the key comes out, the coupling has to be hammered off. Blocks of wood and pieces of copper are talked about, but some one discovers old hammer marks on the coupling, and this is taken as a license to pound it all to pieces.

By the time the coupling comes off, two or three pulleys have been cracked or broken by awkward back strokes. After the coupling is off the real work is done in two minutes. Five or six pulleys are slipped off, the new one slipped on, and the old ones replaced. I say the old pulleys are slipped off, but two or three in the lot will be found so tight that they will have to be slipped off with a sledge. The scientific pounding on the coupling dented the shaft some, and no one ever thinks of filing a dent out of a shaft till he has tried to drive something past it.

The entire process is now reversed, the coupling driven on, the old key searched for and not found, a new one ordered, the old one found in the meantime, the old one found to be so battered up as to be useless, all hands wait for the new one, head man gets tired waiting and concludes to sock the old ones in, does so, shaft pried into place, two bolts put in, two bolts found so battered up as to require a thread to be filed on them and the upset filed out of them, and at last the job is complete and the boys go to "work" again.

Total cost of putting on new pulley—cost of pulley, plus four hours' total expenses and labor of a small machine shop, plus four hours' idleness of a small machine shop. Total equals cost of half a dozen split pulleys.

* * * * The description I have given of this job only applies if the job happens to be a lucky one. Generally the shop comes to a standstill about an hour after the job is done; some big belt to be put on. After a while another stoppage; forgot to tighten some pulley. Another stoppage; a pulley is set two inches out of place.

Next day there is half a stoppage. Part of the shaft stops and part keeps on. Some slip collar was left loose, and some loose coupling crawled right off of the shaft. This is easily fixed, and is made an excuse for tightening all set screws which have been loosened. The next day the real snarl comes. It is found that in replacing the old pulleys one of them got put on in the wrong place. There is no way out of this but to go through the whole job again. The only reason the second doing of the job is not as laborious as the first is that the fits are all fresh.

* * * * Split pulleys are easily and cheaply put in place. Thirty minutes will generally do for placing one. The shaft is not marred by set screws or other such fastenings. The couplings become simply an expedient to save making a shaft in one length.

* * * * Very respectfully,

CHORDAL.

Notes on the Mechanical Engineers Meeting.

We continue our notes from the last issue upon the first annual meeting of the American Society of Mechanical Engineers. It was the unanimous sentiment of those present that the selection of the Union League Theatre, as the place of holding the two days' (and two evenings') session, was a peculiarly fortunate one. Few meetings of engineering societies have attracted as much attention from the daily press as the one referred to in these notes. This goes to show the importance attached by the general public to the consideration of mechanical topics, by a representative body of American mechanical engineers. We are glad to note this prominent fact, as many engineers have accustomed themselves to underrate the depth of interest felt in mechanical progress by the public at large.

In addition to those mentioned, or published in our last, the following papers were read and discussed at this meeting: "The Compound Engine," by J. C. Hoadley (oral presentation); "Measurement of the Friction of Lubricating Oils," by C. J. H. Woodbury; "Strength in Machine Tools," by Charles T. Porter; "Efficiency of the Crank and Adjustment of Cushion in Steam Engines," by Prof. S. W. Robinson, of the *Ohio State University;* "A New Type of Regenerative Metallurgical Furnace," by Jacob Reese; "Standard Screw Threads," by George R. Stetson; "Practical Methods for Greater Economy of Fuel in the Steam Engine," by Allan Sterling; "Putting a New Crank Pin in the Engines of the Steamship Knickerbocker," by Lewis Johnson; "Mechanical Correctness," by Charles A. Hague; "Packing for Piston Rods and Valve Stems," by Lewis F. Lyne; "Value of the Study of the Mechanical Theory of Heat," by A. R. Wolff.

Some of these papers have already appeared in our columns, and others will follow.

The discussion which followed the reading of the paper on the Metric System by Coleman Sellers showed a general concurrence in the views presented by it.

Mr. C. E. Emery said that, after hearing Mr. Sellers' paper he felt even more conservative in regard to the Metric System. Still, that system, when actually in use, was not so bad as would appear from the strong statements which had been made respecting it. The earth could be measured by meters. Shafting and other things could be measured similarly, if we were once in the way of using the system for such purposes. But

the question was, whether, after the labor that had been expended in this country, using the inch as the standard, it would be judicious to change. He would certainly favor adhering to the present system. But at the same time, to speak disparagingly of other systems, would be in the sense of "love's labor lost."

Mr. C. T. Porter thought that for convenience, no standard could compare with the inch. It was convenient on account of its size and on account of the fact that it could be divided, and in ordinary practice was divided, by continual bisection. That system of division for practical purposes was incomparably superior to the decimal system. The meter was so inconvenient that the millimeter had, in practice, been substituted as the unit. It afforded him unmeasured gratification to hear, at the first meeting of the society, so complete and exhaustive a demonstration of the absurdity of the proposed change, as had been presented by Mr. Sellers.

Mr. Worthington was sure that he had never known a member of the plain, practical profession of mechanical engineering who advocated out and out a change to the metric system. But he had known men who calculated eclipses and did other things of that sort who were in favor of the change. The matter of making calculations had been a comparatively small part of his labor. The thinking out of what he had to make had been much more important. He suspected that the proposal for a change came principally from quarters where very large calculations had to be made upon a very small amount of original thinking. The metric system suggested nothing at all. It was associated with none of the ideas of his life. Before he could get any idea from a metric expression, he had to take his pencil and cipher it into feet and inches.

A resolution was offered by Mr. Worthington and seconded by Mr. Holloway, that the Society deprecates any legislation tending to make obligatory the introduction of the metric system of measurement into our industrial establishments, and the secretary was instructed to procure a vote on the same by letter ballot.

Towards the close of the last day's session, Mr. Holley offered the following resolution, which was carried:

Resolved, That the thanks of the Society be presented to its treasurer, Mr. Lycurgus B. Moore, for his prolonged, difficult, and faithful service as acting secretary during the interval between the organizing and the present meetings.

Prof. Thurston said that he had had occasion to know something of the work done by Mr. Moore. He had done an amount of work that very few people could imagine. Before the organization of such a society as this could be completed, many things had to be done which ordinarily were referred to committees. But Mr. Moore had handled almost the whole thing, and the most that the President had had to do was to confirm, usually, the methods advised by the treasurer. He had done the double duty of secretary and treasurer with an efficiency that could not be excelled, and with a degree of good nature which very few men could equal.

The following standing committees were announced by the President:

ON ROOMS AND CONVERSAZIONE.

J. C. Hoadley,
Eckley B. Coxe,
J. C. Bayles,
A. Faber DuFaur,
Frederick R. Hutton.

ON REGULAR MEETINGS.

Washington Jones,
Coleman Sellers,
Wm. Lee Church,
M. N. Forney,
Charles E. Emery.

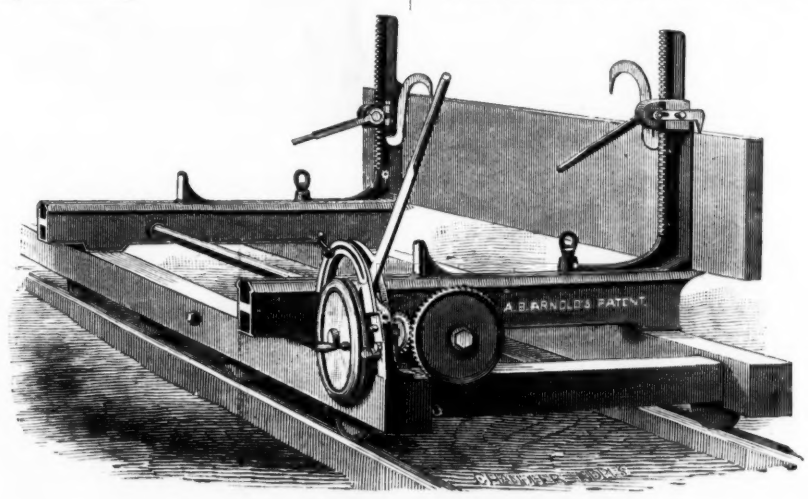
The next regular meeting of the Society will be held in some other city next Spring. Timely notice will be given in these columns.

There is a project to hold an International Railway Exhibition in Berlin in 1882 or 1883 to illustrate the development of railroads.

Improved Head Block and Dog.

The new friction clutch head block and automatic dog, illustrated on this page, has been devised by one who bases his judgment, as to the requirements, upon twenty years experience in operating and putting up saw-mill machinery. He presents the requirements as follows: First, accuracy, without which no mill can make even lumber. Second, ease and facility in handling, which is necessary to do fast work. Third, simplicity and durability in construction.

The device for operating this block is a friction clutch and knuckle joint combined, acting on the inside disc of the hand wheel, giving a very positive and direct movement to the knee that moves the log—so positive and sensitive, that the operator cannot move the lever in the arch one-sixteenth of an inch without moving the knee a corresponding proportional part. They will set to the one-hundredth part of an inch with perfect accuracy, if necessary, enabling the sawyer to make any variation for thickness of saw or cut of kerf, making lumber of even and uniform thickness under varying circumstances. The sliding stop on the arch can be adjusted at any point desired. By turning up the small latch that the lever rests upon in the arch, disengaging all the clutches, the operator can take hold of the hand wheel and run the knees back or forward at will. By turning down the latch the whole is locked perfectly tight and ready for setting.



IMPROVED HEAD BLOCK AND DOG.

The accompanying cut shows a single-acting, simultaneous rack and pinion block. They are manufactured both double and single acting, simultaneous, and independent, with rack and pinion, or screw, as desired; all operating on the same principle and equally correct. The double-acting simultaneous and independent screw block can be operated with great ease and facility. The head sawyer or setter can move either knee to any desired point by the graduated scale on the arch, without changing his position at the lever. One block can neither gain nor fall back of the other, while the peculiar construction of the device operating them prevents any lost motion from wear. It is claimed they will set just as correctly until entirely worn out as when new.

The new automatic dog holds the log firmly to the knee, and firmly down to the block, so that it can neither raise nor work off from the knee. This dog holds logs from five feet diamater, down as small as desired. Frosty or frozen timber is held without rebounding, or flying out. They are forced into the timber by a lever that acts upon a small pinion that works in a rack on the back of the knee. Throwing up the lever draws the dogs out of the timber.

This combined head block and dog is manufactured by the Atlas Engine Works, Indianapolis, Ind., under personal supervision of the inventor, A. B. Arnold.

The Pitsburgh, Youngstown and Chicago Railroad Company is a new corporation which proposes to build a road from Pittsburgh, via Youngstown and Akron, Ohio, to connect with the Baltimore and Ohio road at Chicago Junction, 190 miles.

Strength in Machine Tools.

BY CHARLES T. PORTER.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

This Association can vindicate its right to exist only by exerting a constant beneficial influence upon engineering practice in all its departments. At the outset of its career, it should take a progressive attitude, planting itself upon sound principles of construction, aiming to inspire the engineers of our country with the highest conceptions of mechanical truth, and to diffuse a correct understanding of the means and methods by which this is to be attained.

As one subject of primary importance, I wish to present that of strength in machine tools. Truth of construction, facility of operation, and range of application are all, in one sense, subordinate to this fundamental quality of strength; for they are in a greater or less degree impaired, where adequate strength is not provided.

But what *is* adequate strength? On this point there exists among the makers and users of tools a wide diversity of opinion. And on examination it will be found that this diversity coincides with the diversity in mechanical sensibility. As the mechanical sense is developed, there arises in just the same degree the demand for greater strength in machine tools.

To the mechanic who has never formed a notion of a division of an inch more exact than "a bare 32nd," one tool, if it can in any way be kept from chattering, is as good as another, and better if it is cheaper.

To those, on the other hand, who demand in every piece, as it comes from the tool, the closest approach to perfection, both in form and finish, a degree of strength in the tool appears, and is demonstrated, to be indispensable; that to the former class seems as absurd as the results attained by means of it appear incredible.

In this country, as indeed all over the world, the standard of mechanical truth has been very low. It is here, however, as every where, rapidly rising. The multitude are being educated up to the standard of the few. In this work members of this Association have borne and now bear an honorable part. Just in the degree that the standard of mechanical excellence is raised, must the demand become more general for greater strength in machine tools, as indispensable to its attainment.

But what is the standard of strength? The anvil affords perhaps its best illustration. It is a strength enormously beyond that which prevents a tendency to chatter, a strength that under even the heaviest labor, prevents the least vibration of any part of the tool, or any indication of effort, more than if the object being cut were a mass of butter.

It will be seen, that this absolute solidity in machine tools, while truth cannot be attained without it, enables also mechanical operations generally to be performed with far greater expedition, and the subsequent work of the finisher to be in any case much diminished, and often dispensed with entirely.

We are enabled, in most cases, to come a once to the form desired, whatever may be the quality of material to be removed, and always to finish the surface with a degree of truth and polish otherwise unattainable, dispensing, in a great measure, with the use of that abomination, the file.

Now with this standard in our mind, we look over the face of the land, and behold it covered with rubbish.

It is curious to observe how ingenious tool makers have generally been in trying to avoid this quality of strength, and how deceptive an appearance in this respect many tools present.

It is interesting also to note how little this quality of solidity adds to the cost of casting. The addition is merely so much more pig-iron, and really not that, because in the stove-plate style the forms are more complicated, the patterns more expensive and frail, and the cost of moulding is greater. But what signifies even a considerable increase in the first cost of a tool, that in daily use is to perform the work of many, and is to place its possessor on a mechanical eminence?

It is not the purpose of this paper to enter into details, interesting and important as they are, but to draw attention to the subject in a general way. The improvement observed quite recently in this respect, as well as in other points of tool construction, is highly gratifying, and encourages the expectation of still further and more general progress.

The directors of the Louisville and Nashville R. R., it is said have decided to complete the Knoxville branch road to the Tennessee line, where it will be met by a road from Knoxville, Tenn. Work on the extension will begin immediately, and it is expected that cars will be running to Knoxville by January 1, 1881. This road was projected years ago, but in 1870, when it had reached Livingston, Ky., a distance from Louisville of 140 miles and about 100 miles from Knoxville, work was suspended.

A large undertaking has recently been completed in Russia, in the shape of a long railway bridge over the Volga. The width of the river is nearly a mile, and as it is liable to very heavy spring floods, the piers—of which there are fourteen—had to be built 100 feet above mean water level. The girders, 364 feet long and 20 feet wide, were all riveted and put together on the right bank of the river, and then floated to their position. The whole cost of the bridge was 7,000,000 silver roubles, and it is worthy of mention that it was completed without any loss of life or any accident of importance.

In Sweden, wherever a railway crosses a common road, gates are erected on each side. Five or ten minutes before a train is due these gates are closed and not allowed to be opened until the train has passed. There are no chances taken by railway companies; they simply fence impatient people out.

The Newcastle and Rushville Railroad Company, incorporated in the interest of the Fort Wayne, Muncie and Cincinnati Company, to build a road from Newcastle, Ind., the terminus of the latter road, south to Rushville, twenty-four miles, has secured the right of way and something over $2,000 per mile in local aid. If the weather is favorable it is hoped to have the road completed by January. In connection with the North Vernon, Greensburg and Rushville Road, now building, it will give a very direct route to Louisville.

It is proposed to establish a plate glass manufactory in Chicago if sufficient capital can be raised for the enterprise. There are now four plate glass factories in the United States, located one at each of the following towns: New Albany, Ind.; Jeffersonville, Ind.; Crystal City, Mo., and Louisville, Ky.

The Skinner Combination Chuck.

The latest improved Combination Chuck that has come under our notice is the one shown in the engravings on pages 4 and 5, and which was referred to in our issue of October 2d. The jaws, as will be noticed, are moved in and out by means of screws, which are simultaneously operated by means of pinions upon the ends of the screws, which gear into a circular rack, and thereby have their motion communicated from one to the other, so that when one screw is moved they all move together.

As it is sometimes desirable to move one jaw independently of the others, a simple mechanism is provided for this purpose. By means of this device a universal chuck can be readily converted at will into an independent jaw chuck. The chuck is, therefore, universal, independent and eccentric.

Fig. 1, shows a front view; Fig. 2, a back view, and Fig. 3, an interior view of the face portion of the chuck, the latter being divided so as to leave the pinions which gear into the circular rack in the front part. Fig. 4 shows an interior view of the rear portion of the chuck. Fig. 5 is a view of the under side of the cam ring, which fits into a groove in the rear part of the chuck frame under the circular rack. Fig. 6 is a circular rack formed upon a plain ring which lies upon the cam ring in the same groove, in the rear part of the chuck frame, in which it can turn freely.

Upon the under side of the cam ring (Fig. 5) are the projections, or cams *B*, which, in one position of the ring, lie in depressions in the rear case, as shown by *A*, in Fig. 4, but when the ring is slightly turned, rise up out of the depressions or sockets and raise the ring and the rack above it. The position of the rack (Fig. 6) and the ring (Fig. 5) in the groove is such that when the cams *B*, are in the sockets *A* in the case, the rack does not come in gear with the pinions, but when the ring (Fig. 5) is turned so as to lift the cams out of their sockets, the rack is raised so as to engage the pinions.

C, is a stud, passing through a slot in the back of the case by which the ring (Fig. 5) is turned, to throw the cams *B*, in or out of their sockets.

E, *E*, *E* are springs fixed to the face part of the case, and pressing against the face of the circular rack (Figure 6), with their free ends so as to hold the rack closely in contact with the ring (Figure 5) and press both the rack and ring back against the case of the chuck, and forcing the cams *B* into their sockets when they are in proper position.

The circles on the face of the chuck are for the purpose of setting the jaws true. If the chuck has been used as an independent jaw chuck, and it is desired to use it as universal, move the jaws until the outer edges are perfectly true with either the inner or outer circle, as most convenient (being particular to have the jaws all on the same circle), when by sliding the stud *C*, the rack will be thrown into gear with the pinions, and the chuck is ready for universal work.

One important improvement presented in this chuck is a device for securing the ready and easy adjustment of the steps, or surfaces of the jaws, so that they shall be in the same plane at right angles to the axis, and hold any object placed within the jaws in a true position.

The improvement consists in arranging and constructing the jaws with adjusting screws, the heads of which form a rest for objects placed in the jaws.

D, *D*, *D*, in Fig. 1, show the screws let into the vertical faces of the jaws.

In Fig. 7 these screws are also shown. They are intended to be flush with the faces when the chuck is finished, but are capable of being screwed out when required. Whenever, by use or from any cause, the faces of the jaws are found out of true, the several faces in the different jaws, which should be in the same plane, can be readily adjusted by screwing out the screws until the projecting heads are in the same plane, at right angles to the axis.

All parts of this chuck are made interchangeable, so that any part broken or worn out can readily be replaced. It is manufactured by the Union Manufacturing Company, 96 Chambers St., New York.

President's Inaugural Address.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS, NEW YORK, NOVEMBER 4, 1880.

BY R. H. THURSTON, A. M., C. E., PROFESSOR OF MECHANICAL ENGINEERING IN THE STEVENS INSTITUTE OF TECHNOLOGY.

(*Concluded from last issue.*)

We call from all lands their most enterprising and industrious workers, and we send to all lands the best devices for creating the most essential comforts and the greatest luxuries. The United States is looked upon as the home of all ingenious and effective "labor-saving" devices; this is the natural home of the finest wood-working machinery, and all foreign nations imitate our designs; the American steam engine has revolutionized the steam engine manufacture of the world; the introduction of navigation by steam here, led to the construction of steam vessels on all waters, and one of our steamers—the "Savannah"—was the pioneer in trans-oceanic navigation; our mowers and reapers gather the harvests of every field from Oregon to Maine, and from Great Britain to the most distant countries of Europe, and are even seen among the semi-barbarians of farthest Asia; the American rotary printing press sends out its stories of daily life and its records of the history and of the knowledge of all peoples in every quarter of the civilized world. And thus in myriads of ways the modern civilization, which is reaching its highest development

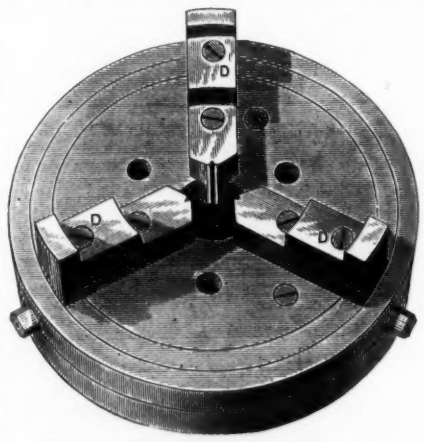


FIG. 1.—FRONT VIEW OF CHUCK.

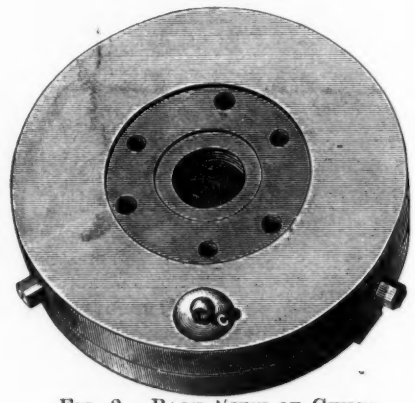


FIG. 2.—BACK VIEW OF CHUCK.

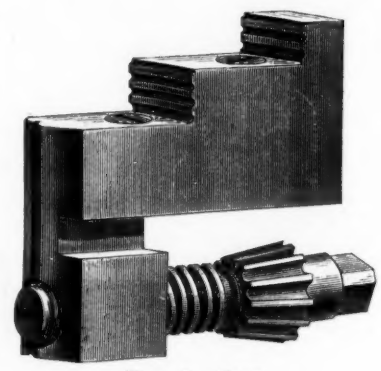


FIG. 7.—JAW.

in this new world, is reaching out to touch and to revivify every other nation. It is of this civilization—a civilization which seeks directly useful and practically valuable results—that you, and such as you, are the vitally essential supporters and promoters.

It is by such men that this only real civilization—which had its origin among the ruins of the old worlds of Greece and Rome, and which, checked by the destruction of the wealth and the science schools, the arts and the industries of the Saracens—has been revived within a few centuries, and given its wonderful growth—a growth which is still going on with ever accelerating speed. It is by such men that the value, the absolutely essential necessity, of intelligent labor has been forced upon the world, that the dignity of labor has been made known, and its acknowledgment compelled from those who, moulding general sentiment, had hitherto associated intellectual labor with manual indolence, and had despised the hard-working mechanic and every mental effort which led to other than non-utilitarian ends; that the Rip Van Winkle of the Middle Ages was awakened from that slumber of a thousand years, and taught to work the printing press, to labor at the forge, and the loom, and to educate his children in such a manner as, by profitable exercise, to develop together mind and body, and was given the power of making life worth living, while becoming daily better fitted to live the truest life.

Such men have taught the world that the true and only way to secure the greatest good of the greatest number, to obtain the blessings of stable and wise government, to secure a fair and equitable distribution of all those forms of wealth which are most essential to a life of happiness and content, to obtain for all an equal opportunity of gaining with certainty, and holding safely, the best fruits of intelligently directed industry and to bring every nation most promptly, and with most stability, to a state of maximum prosperity, is to educate a people in all the useful arts and in all true philosophy, training mind and hand together, and fitting soul and body to co-operate in doing the work of a citizen in the community. We have begun to learn to despise mere speculation, whether in finance or philosophy, and to adopt the modern system of philosophy, which bases knowledge on ascertained facts and upon logical deduction from such facts; we are learning to abandon those old habits of thought which come from over-respect for ancient methods and philosophies, to turn from the study of the teachings of less civilized times and peoples, and, leaving the Greek and the Roman to his own half-knowledge and profitless speculations, to devote ourselves to the acquirement of real knowledge, by directly profitable methods. Abstract philosophy, and the deductive method have, at last, been thrown down from the pedestal from which they so long received the homage of the greatest of mankind, and the Inductive Method of Aristotle, of Galileo, and of many truer men among their disciples than Bacon, has become fruitful of all that tends to make "*Liberté, Egalité, Fraternité*" words having true meaning.

And this is the situation but one hundred and four years after the foundation of our government and the birth of the Nation.

The class of men from whose ranks the membership of this society is principally drawn direct the labors of nearly three millions of prosperous working people in a third of a million mills and other manufactories, are responsible for the preservation and profitable utilization of 2,500 millions of dollars worth of capital, direct the payment of more than 1,000 millions of dollars in annual wages, the consumption of 3,000 millions of dollars' worth of raw materials and the out-put of 5,000 millions of dollars' worth of manufactured products. Fifty thousand steam engines, and more than an equal number of water-wheels, at their command, turn the machinery of these hundreds of thousands of workshops that everywhere dot our land, giving quietly and docilely the strength of three millions of horses, night or day, or all night and all day, whenever the demand comes for their wonderful power.

This society, when it shall have become properly representative of such a class, may well claim position and consideration.

It has been by the work of men whom we are proud to claim as brothers in our own and kindred professions, but whom the world has not always honored as they are honored to-day, that true progress has always been most efficiently promoted. It has been these men who have been made gods and demi-gods in pre-historic times. Vulcan and Thor, the Assyrian Master of Works, the builders of the Pyramids, Archimedes, Hero of Alexandria, Cæsar's Engineers and the author of "Theatrum Machinarum," and Leonardo da Vinci, artist and engineer, and a hundred later and equally great men, are entitled to our homage as masters and teachers in a profession for which we may claim an age of certainly not less than 5,000 years.

Wyatt and Arkwright, who taught us to spin by machinery more than a hundred years ago, and Hargreaves and Crompton, who followed those inventors; Jacquard, who perfected the pattern-loom, which to-day weaves with equal facility the portrait of him who was "first in war, first in peace, and first in the hearts of his countrymen," and the most beautiful and ingenious combinations of form and color of which decorative art is so wonderfully prolific; and Cartwright, who first harnessed the steam engine to the loom; Hammond and Heathcote, who made the stocking-loom; Watt and Fulton, and Stevens, Fourdrinier, Howe, and McCormick, Whitworth and Siemens, and Bessemer, Hoe and Bullock, Smith and Ericsson, and such great names glitter all along the list upon which we are glad to be permitted to inscribe our own obscure names, while the name, here and there, is seen of a great mathematical genius like Rankine, and of a great philosopher like Spencer, shining with a radiance that never comes but from a towering intellect, enlightened by wisdom and sparkling with that purest brilliancy which is acquired only by study, and thoughtful labor in the loftiest atmosphere of human thought.

THE FUTURE.

It is by the past that we are to judge the future, and the rapid advances of the past century, in all branches of mechanical science and the mechanic arts, are simply indicative of greater advances and more rapid acceleration in the future.

We have seen greater advances made in all the great industries during the past century than during a dozen centuries preceding it. The progress, which to-day apparently culminates in the light and effective reaping machine, cutting in one hour more grain than our sturdy grandfathers could reap in a day, making the clustering stalks into bundles with tireless and deft metallic fingers, which bind them and tie them as could no human hands, in short, almost a miracle of human ingenuity; in the sewing machine, which has done so much to relieve the sad, toilsome monotony of the life of those poor creatures whose hard fate inspired Hood's "Song of the Shirt," and which accompanies American mowers and reapers to every foreign land, there to do one of the truest of all kinds of missionary work; in the spinning and weaving machinery which has been taught to produce the fabrics that comfortably clothe the poorest, as well as the richest, and most artistic patterns that wealth demands or art desires; in the printing press, that has made civilization and educated intelligence possible, and which is the great safeguard which preserves our nation from retrogression, from internal decay, and from external aggression more effectively than could the armies of an Alexander, of a Cæsar, or of a Napoleon, which supplies us with newspapers printed by the mile, and with books freighted with all human knowledge so cheaply that the poorest in the land may, at the sacrifice of the least of his few indulgences, read the thoughts of the wisest men of all ages, and

learn of the latest and greatest discoveries and inventions of this age of wonders by the light of the street lamp, or of the dim candle that faintly burns in attic or cellar; in the steam engine that drives all these other triumphs of invention, and which impels the great trans-oceanic steamers, carrying thousands of tons of valuable freight and hundreds of precious lives, twenty miles an hour, accomplishing the three thousand miles of heaving ocean which separates us from the mother country, in a single week; which transports us from one great metropolis to another at the rate of a mile a minute—that progress which thus has seemingly culminated in a perfection of invention and a fruitfulness of production that appear to us impossible to greatly surpass, has really, so far, exhibited, we may be confident, but the earliest stages of an onward movement that is like the motion of a meteorite, attracted toward the center of the nearest star with a velocity which increases as it flies and which continues to increase without lessening and without fluctuating to the very end.

We are now called upon to do our part in the work so well begun by our predecessors, and so splendidly carried on by our older colleagues during the past generation. We have for our work the cheapening and improvement of all textile fabrics, the perfecting of metallurgical processes, the introduction of the electric light, the increase of facilities for rapid and cheap transportation, the invention of new and more efficient forms of steam and gas engines, of means for relieving woman from drudgery, and for shortening the hours of labor for hard-working men, the increase in the productive power of all mechanical devices, aiding in the great task of recording and disseminating useful knowledge; and ours is the duty to discover facts and to deduce laws bearing upon every application of mechanical science and art in field, workshop, school, or household.

Every member of the engineering profession has his share of this work, not only in his private capacity, but as a member of a great body of men of kindred pursuits, each of whom may be rightfully called upon to give to his neighbor of his own light, and to assist in promoting the general welfare.

METHODS OF WORK.

And the question arises, "How are we to work, and what is wanted of us; what is the best method of advancing this department of knowledge; what method is most truly philosophical and most productive of results?"

The question is soon answered. There is, as I have already elsewhere taken occasion to show, but one philosophic method of advancement of science.*

We are to decide upon methods of working and upon plans in detail, and we are to initiate these schemes with promptness and intelligence.

We must seek to acquire a knowledge of facts, to understand natural laws, and to ascertain their positions and their mutual relations in nature's code. We are to endeavor to hasten the approach of that great day when we shall have acquired a complete and symmetrical system of mechanical and scientific philosophy.

Our methods must be simple; they must be comprehensive, and they must be productive of maximum results in giving our industrial system such form and such distribution of material, that its work shall be done with highest efficiency and economy.

The first step in any such work is the careful collection of facts and the patient study of all phenomena involved, and the registry of such facts and phenomena in the most accurate possible manner, and so systematically and completely that they shall be readily and conveniently available, and in such shape that their values and their mutual relations shall be most easily detected and quantitatively measured.

In this work we need the aid of careful and precisely-directed observation, and if we can secure the assistance of men whose powers are exceptional, and whose skill has been perfected by training and experience, and who are prepared by habits of study to direct such effort and to supply the demand for the application of knowledge already acquired, we shall find our work immensely facilitated.

We have, therefore, the task before us of determining what are the directions in which investigation is most needed, and to decide what path research shall take. We are to find, among associates and colleagues, men well fitted to undertake such work, and encourage them to take up the labor of investigation; we must find for these self-sacrificing students of science, pure and applied, means sufficient to enable them to work efficiently and productively; we must learn to narrow the gulf which has separated men of business from men engaged in study, in experiment and in diffusing useful knowledge; we have to exhibit the fact that a community of interests exists between these two classes, and that it is as impossible for industry to prosper thoroughly without the aid of the investigator, the philosopher, and the inventor, whether of a machine or a process, as it is for the researches progressing on all sides in applied science to go on without aid from those whose business it is to acquire tangible wealth. He who gains wealth is invariably largely, even though usually indirectly, indebted for his prosperity to him who, without thought of pecuniary gain, is unselfishly devoting life and health to the attainment of scientific knowledge.

Science and the most perfect art can only flourish when assisted by wealth, and wealth can only come with least sacrifice to a country in which the true spirit of inquiry is awake and stimulating investigation. The more nearly men of the world and men of science are brought together, the more prosperous are all classes, and the happier and more contented are the people. We need all—observers, discoverers and inventors; explorers of all fields of research; students of Nature's facts, and codifiers of Nature's laws and teachers of all applied sciences, as well as workers in field, in workshop and in office. And we must have men who seek that highest honor which comes of the endowment of science—philanthropists, like Stevens, and Rosse, and Case, and a hundred others who are not, like these, members of our own profession, whose gifts have been the most splendid of charities and the most beneficent of all great work.

*Vice President's address before Section H of the American Association for Advancement of Science: "On the Character of Physical Science and on the Philosophic Method of the Advancement of Science," at St. Louis, 1878; Trans. Am. Asso., Vol. XXVII.

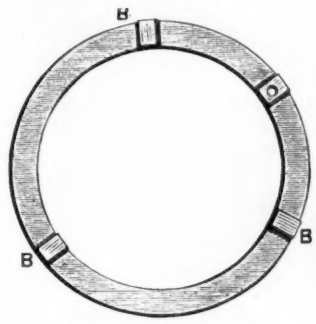


FIG. 5.—CAM RING.

FIG. 6.—CIRCULAR RACK.

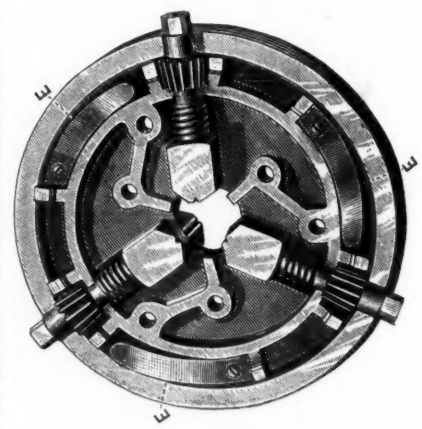


FIG. 3.—FRONT PLATE.

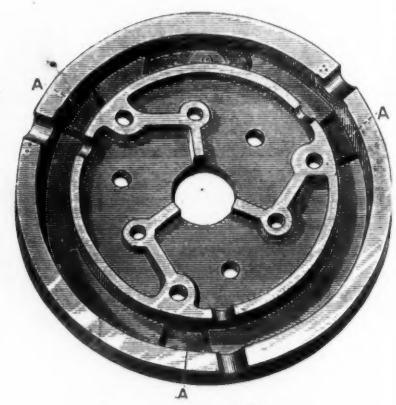


FIG. 4.—BACK PLATE.

AN EXAMPLE.

As an illustration of the method in which advancement occurs, and as an example of the kind of work which remains for us to do; let us glance, very briefly, at the history of that greatest of modern triumphs of mechanism, the steam engine.

Away back, twenty centuries and more, in the dim past, among the first faint gleams of historic civilization, we see the germ of the invention which has done so much to annihilate space, and give man illimitable power over all the forces and treasures of nature—a toy in the museum at Alexandria. A toy it remained many centuries, until, in the grand awakening of three centuries ago, its latent power was discovered, and Papin, and Worcester, and Leibnitz, and Huyghens each contributed a thought in the progress which they thus inaugurated. A hundred and fifty years ago, the "steam giant" was at work under the direction of the intelligent blacksmith and his comrade, the "tinker," doing much for the mining industry, but nothing elsewhere, and, hampered by ignorance, and ill-cared for by his masters, wasting a vast deal of now utilized power.

Then came forward a genius of the brightest intellect, a mechanic, such as the world rarely produces—James Watt—and, adopting the truly philosophic method, the great master soon taught the mighty servant to do a thousand times more for the world, and to labor with wonderfully greater ease and economy. Watt first collected his facts. He dissected the model of the Newcomen and Calley engine, which had been placed in his hands for repair, ascertained the method of its operation, learned what were the advantages, and what the disadvantages, of that form of engine, discovered the cause and extent of its losses of power and efficiency, and once these were known, his grand intellect promptly devised remedies and improvements, and the steam engine of to-day is simply the steam engine of James Watt, in all its leading features and in all the principal details of design. Its steam-jacketed cylinder is Watt's; its parallel motion and its guides; its crank motion—although an invention usually ascribed to another—were invented by Watt, and the condensing apparatus, the expansion gear, the governor, and even that wonderful little instrument, the "indicator"—the engineer's stethoscope—all came down to us from the same source.

Watt learned the leading facts, and made the greatest modifications of plan, while it was reserved for our contemporaries to contribute the refinements of its design and of its manufacture, and to study the more deeply hidden principles of its philosophy, and to determine more definite rules for its construction and management.

Those of you who have been familiar with the design and construction of steam engines during the past twenty or thirty years,† and those of you who have been for a generation past accustomed to handle this miracle of art, will remember, as I remember well, how we learned at a very early period in our experience, certain cardinal points of practice which were very strongly impressed upon us. We soon learned by experience that efficiency was gained only as we learned to handle higher steam with properly adjusted expansion, to work our engines up to higher piston speeds, to cushion heavily when we had large clearance, to reduce that clearance to a minimum, to adjust the size of our engine to its work, and to determine the point of cut-off, under proper conditions otherwise, by the governor. ‡We learned that the now well-known "American Automatic Cut-off Engine," with its high steam and moderately large expansion, as exemplified by the "Corliss Engine," which is now built all over the world, was the representative of best general practice.

But we were not satisfied. Twenty years ago we began to understand that we had yet to perfect the philosophy of the steam engine, and that it was still apparently far from perfect efficiency. We then discovered that while our best engines were consuming from 25 to 30 pounds of dry steam per horse power per hour, the mechanical equivalent of the heat supplied to the steam in the boiler was sufficient to give about a horse power per each two pounds of high-pressure steam per hour, and hence that we were utilizing but one-tenth or one-fifteenth of the heat we were paying for when we settled our coal bills.

Next, we found that, owing to the fact that we cannot practically expand down to a pressure lower than that due approximately to the temperature of surrounding bodies, that we must therefore discharge heat unutilized, that the larger part of this waste is unavoidable and that an engine, perfect mechanically and working within the maximum usually practicable limits, must waste three-fourths, and can return useful effect from but one-fourth of the heat supplied, thus placing the practical limit under known conditions at about eight or ten pounds of steam per hour per horse power.

And here we stand to-day with the steam engine, mechanically almost perfect, yet with a theoretical economy of about eight or ten pounds of steam per horse power per hour while consuming actually, in the best examples, about fifteen, *i. e.*, with an efficiency of sixty or seventy per cent.

In hot-air engines we are not making much more rapid progress, and our field of promise seems to be still in the improvement of the steam engine.

We are slowly learning other facts. We know that the great obstacle in the way of attaining nearly theoretical efficiency is the transfer of heat from the steam to the exhaust side by initial condensation and re-evaporation; we are discovering that high speed and steam jacketing tend to lose their efficiency at extremely high pressure with wide ranges of expansion, that it seems possible to reach a point in steam-jacketed cylinders at which lower speed may tend to secure efficient working of the steam; that with well-jacketed cylinders we may get good performance, as we to-day judge it, with slow pistons; that we have better work claimed to-day for single than for "compound" engines by ten or fifteen per cent., § the minimum yet reached under fair conditions for economy being stated to be by experiment as 1.54 is to 1.75, while,

†Report on Machinery and Manufactures at Vienna, 1873, by R. H. Thurston, etc., etc., Wash., 1875.

‡ History of the Growth of the Steam Engine; International Series; N. Y. 1878, p. 473.

§ Abstracts of Papers, No. 1602; Proc. Brit. Inst. C. E. Vols. LIII, LIV. It would seem that where slow piston-speed is demanded, as usually with pumping engines or where two cylinders are needed as with marine engines, the "Compound" engine is unmistakably best; while where high-speed engines are permitted, as in mills, the single-cylinder may still hold its own in this competition.

assuming the very best conditions for each, it seems certain that both types should give about equally good results.

Here is where we stand to-day, and it is from this point that we are to work forward. We need to collect more facts by means of carefully-devised experiments like those of Hirn and Hallauer abroad, and of Emery, and of the Navy Department at home; we need careful and systematic study of the results and finally the determination of the laws of steam engine efficiency as affected by steam pressure and temperature, rates of expansion and compression, character of steam jackets, rate of piston speed, and every other circumstance influencing economy.

THE ETHICS OF CO-OPERATION.

This, and such as this, is work for some of us, and such work is to be done in every one of the many branches of industry which are here represented. And this, too, is a kind of work in which all can take part, fully confident that the good work shall benefit all and shall injure no one member of the human race.

That great member of our profession, that engineer who has become the greatest philosopher of our age, or indeed, I think, of any age—Herbert Spencer—in his last and culminating work, the "Principles of Morality," shows us, in his "Data of Ethics,"* how the natural evolution of the noblest conduct, as traced by the scientific mind of the moralist, accords perfectly with that dictated by the noblest minds and best men of all times, as well as by the truest Christian philosophers.

The great moralist shows us that naturally right conduct—scientifically correct conduct—toward which we are constantly progressing, as civilization and intelligence advance, as well as righteous conduct, such as the best of men admire and teach, leads to the care of self, of family, of friends, of fellow-citizens and of mankind, by the individual and by society, in such a manner as shall, at the same time, most perfectly protect the interests of each individual, while to the least possible extent injuring his neighbor in the process; and he further shows that perfect conduct, whether considered scientifically, or morally and religiously adjudged, will be attained when we shall have learned to fully protect and preserve self and family, and to individually attain length of life, perfect health and unalloyed happiness, while yet, in the same degree of completeness, promoting the same end as sought by each of our neighbors and by society at large.

In other words, when we shall have become sufficiently intelligent, and sufficiently good, to exhibit "*perfect conduct*" in all our relations, we shall find that the promotion of mutual welfare is, in the highest degree, consistent with—and that it is only consistent with—the highest, the most perfect system of mutual co-operation and mutual aid in all the truest and highest aims of life. Then, this point reached, life will really become "worth living," and mankind will occupy a place very, *very* "little lower than the angels."

This, then, is the fundamental rule of action, and these are the principles which, we may hope, will always guide the American Society of Mechanical Engineers in every effort to aid the profession and to benefit the world.

*"The Data of Ethics." By Herbert Spencer. New York: D. Appleton & Co. 1880. 12mo. pp. 288.

Combined Filter-Pump and Heater.

The engraving on this page shows a combination pump and feed-water heater recently introduced by D. E. Rice, Detroit, Mich. The following distinct advantages are claimed for it: The water is heated to 212° and the pump being inside the heater, there is no loss from radiation. It is a good lime extractor, is cheaper than a separate heater and pump, and more durable than the old styles of either—involves no trouble in management and causes no leakage of pump or heater, prevents freezing up in winter through want of care, secures purity and economy of water by using condensed steam and insures a freer and dryer exhaust.

The cut represents the heater and pump to be driven with a belt. The belt, when convenient, should be near the boiler. The cut shows the pipes attached so that only a part of the exhaust goes to the heater. Other styles are made in which all the exhaust goes to the heater.

A, is the pump driven with crank shaft, and pulley, as shown.

BB, are pump valves. The inside valve, it is claimed, can be taken off and replaced quicker than on the ordinary pump.

C, is a door opening into the heater. This door is large enough to take out the whole pump if wanted, and is fastened by one set bolt, two or three turns of which loosen or tighten it.

D, is the feed pipe from heater to boiler.

EE, are exhaust pipes, from engine to heater and from heater to open air.

F, is the inlet feed pipe from tank or hydrant, with regulating valve and jet pan inside the heater, directly under the exhaust pipe.

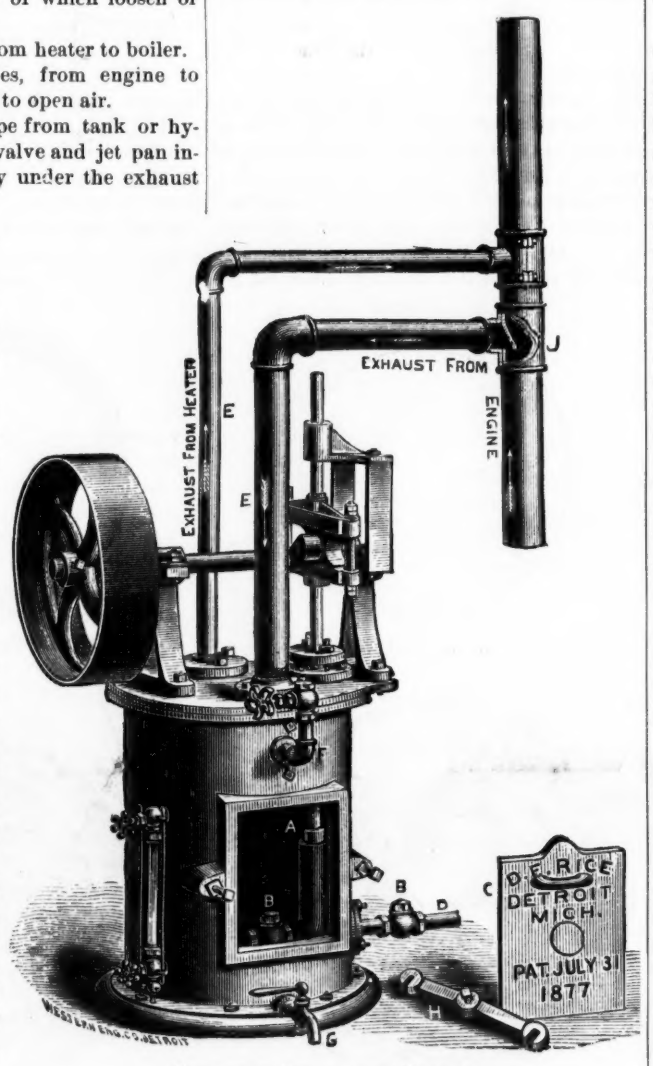
G, is a draw cock for water.

H, a clamp for door.

J, shows how a portion only of the exhaust steam is carried into the heater.

The shell is made of case iron, the flanges of which are faced off to make the joints for the head and doors.

The heads are also of cast iron, and faced off to make the joints on the shell. The joints are made with cement; the door is planed off true and the joint for it is made of rubber. The inside valve of the pump is of best steam metal; one bolt keeps it in place. The plunger is a solid piece of round iron, fitted to the barrel of the pump, and the rod of wrought iron; the pump plunger is worked by the crank and sliding boxes in the yoke; these are planed and fitted up true, and have large wearing surfaces.



COMBINED PUMP AND HEATER.

Letters From Practical Men.

BORING HOLES OF UNIFORM SIZE.

Editor American Machinist:

It may be in order for me to relate my experience in making a large number of holes of uniform size, $\frac{1}{2}$" diameter and $1\frac{1}{4}$" long, in small iron castings. These castings were to be used as pulleys with two V grooves in each; and as they had to be finished all over as quickly as possible, on account of the small price charged, it became absolutely necessary to have all the holes to size, so that they might be turned up true on an arbor, formed by turning down a plug driven into the lathe spindle. The pulleys were held in a universal chuck, and the hole made by a twist drill held firmly in the tail stock spindle.

The live spindle of the lathe being hollow, allowed of a rod being passed through having on one end a rose bit the size of the finished hole, and about $\frac{1}{64}$th larger than the drill. The cutting points on the rose bit were made the reverse of what is usual, or left-handed. This sketch represents a cross section of the body.

It will be seen that by preventing the rod that carries the rose bit from turning, and at the same time giving it a forward motion toward the work, the lathe being in motion, the hole will be finished to size, provided, however, that the casting be soft, that the lathe be run at the same speed as for the drilling operation, and that the rose bit be made like the sketch, that is, with the parts *A* not more than $\frac{1}{32}$" wide, and left as turned or ground, a true cylindrical curve. It should also be left as hard as possible.

Holes made in good castings after this manner will not be as smooth as could be wished, but the first hole will be so nearly the size of the ten-thousandth that Chordal himself could not tell the difference. This result is due altogether to the fact that the rose bit is quite straight, has no keen edges to wear away back of the front or cutting end, has a small surface on each tooth for side contact with hole, is quite hard, and has plenty of clearance for chips. It may be of interest to some of your readers to know how I held the pulleys on the arbor. The idea is new to me, and shall be given to them upon demand. Yours truly,

T. R. ALMOND.

Brooklyn, N. Y.

Standard Sizes of Screw Threads.

BY GEORGE R. STETSON.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

That the millennium in mechanics is likely to come, when a screw of a fixed size from machines manufactured in one shop will interchange properly with the same sizes from other shops, I do not expect immediately; but if a system could be used that established a fixed number of threads for each sized screw, it would be much easier to recut or size bolts than at present; if even sizes, that is, by sixteenths and eighths in place of thirty-seconds and sixty-fourths, yet another point would be gained.

The dropping of the thirty-second sizes would be very desirable, but will require some pressure from the users of stock to attain, as mechanical missionaries are likely to share the fate of some Christian missionaries, and that is to be eaten up by their subjects. The users are reluctant to enforce their demands, though the loss in money is considerable by this oversize. It would seem worth while to have iron as ordered, rather than a thirty-second above. It is a waste to put a half-inch nut on a $\frac{17}{32}$ stock, as the bottom of the thread is about $\frac{3}{8}$ths of an inch for a sharp, and $\frac{13}{32}$ of an inch for the U. S. Standard. This gives the strength remaining after the thread is cut; the remaining stock is only useful to fill the hole through which the bolt runs.

This loss of weight is stated by Mr. Orton, in his report on the subject to the Master Car Builders at their meeting of last year, to be for a five-eighths inch, if increased to $\frac{21}{32}$nds, $10\frac{1}{4}$ per cent.; $\frac{1}{16}$th larger, the extra weight is 21 per cent. For $\frac{3}{4}$ths inch, an increase of $\frac{1}{32}$nd of an inch adds $8\frac{1}{2}$ per cent. These figures represent good dividends, and for large users would pay to look after, as the over-size is waste.

One other point is easy to attain, and under the control of every machine-shop manager. This is to cut the thread tools on the lathe that nearest corresponds to the correct lead in its screw. A one-inch rod turned parallel, and lightly marked with a screw tool cutting No. 16 thread, one foot long, drawing a straight line across the threads, and testing the threads by placing a scale along the line, will show that very few, if any, of your lathes are correct. But take the best one and make all the thread tools on it. When nice work is required, cut the screws on the same lathe. I have found it is best to make lead screws for other lathes, that several lathes may have their lead screws to correspond, thereby saving the screw of the tool lathe from unnecessary wear. The fit between the bolt and nut is very generally from the threads crossing each other, rather than the correct bearing of their surfaces, and until some other method of hardening is devised than the use of fire and water, we shall have all the variations in pitch of threads that can be allowed; but when to this is added the incorrect lead of many lathe screws, there is unnecessary complication.

As regards the choice of standards, the number of threads per inch is the same for the common V (provided there is any standard for this thread), the Whitworth and U. S. Standard, or Franklin Institute systems up to one and a half inch, with the exception of the one-half inch, which, in the U. S. Standard, is 13 threads to the inch in place of 12 in the other standards. As the range from one-fourth to one and a half inch covers the majority of sizes used, it would seem easy to get at the adoption of the number of threads per inch.

The Whitworth system, which has gained extensive use in England, has many points recommending it to favor. The objections are that it necessitates an expensive set of forming tools or chasers to give the rounding outline to the thread. The angle of the sides of the threads of this system is 55°. The outline is formed by dividing the pitch into six equal parts, rounding the top and bottom in such a manner as to leave four of the six parts as working surfaces. This system has not made much progress toward general adoption in this country—the difficulties mentioned are likely to keep it from general use.

What the American system has been would be hard to say. The truth would be that the word system does not apply here. The word usages would take its place and be hard to define. The angle of the thread is usually 60°, though this depended very frequently on whether the grindstone on which the thread tool was ground had been turned off during the month. The sizes are infinite, and the number of threads to each size is infinite also. Some manufacturers, in their attempts to meet the public wants, carry in stock of hand and nut taps, 246 distinct varieties between one-fourth and one and a fourth inch diameters. There are in thirty-seconds, not including the larger machine screws, the great varieties caused by the differences in the number of threads used on each size. The same range is secured by forty-eight taps in the U. S. Standard system. That this want of system may show somewhat the glorious individuality of American mechanics may be true. It is evident, however,

that it is not correct as a business principle, as we hope the time has passed when any mechanical constructor would hope to hold his business by peculiar personal systems of threads. From this chaos what can be done towards an American system worthy the name? The best and only effort (to my knowledge) in this direction has been made by the Franklin Institute, who, through their committee (of whom Mr. Wm. Sellers was chairman) perfected a system calculated to meet the requirements of the country; the system being as easy to construct as the one in general use, requiring but one special tool, and this furnished at a cost within reach of all. (I refer to the Brown & Sharpe U. S. Standard thread gauge.) Its recommendations are: First, it is a system perfected and reduced to figures which it can be worked by. The number of threads for each sized screw is established. The change of the half inch from 12 threads to 13 is the most of a change from established usage of any; and it seems justified, as it more nearly conforms to the general principles on which the system is constructed. The impression that the system alone consists in the number of threads to the inch is a mistake. Its strong point of recommendation is that the flat top and bottom gives to the bolt the additional strength very desirable to attain; as the fact is established that there is more thickness of nut used than is required to draw in two a bolt before the thread strips.

The formula for producing the thread is familiar to you, I presume. The pitch is divided into eight equal parts, the top and bottom of the threads being left flat, equal to one-eighth inch each, or leaving six of the eight parts as the working depth of the thread, and the angle of the thread is the usual 60°.

The report of Mr. Sellers was presented in 1864, or sixteen years ago, during which time the system has been in use, and its correctness of principle established. If we are to have an American system of threads, it would appear that this is the most likely to be adopted, as it has gained an extensive hold in public favor. This system not only extends to the establishing of the form and number of threads to each diameter of bolt, but gives the proper thickness and size of nut, which, for those desiring to attain the best results, it is well to follow, as a thicker or thinner nut is quite a factor in the fitting of threads; as the drawing of the threads of the tap by hardening, and the change which comes to the threads of the bolt by the dies wearing and drawing them, will make the fits quite different between a thick and thin nut.

The questions present themselves: How are we to get and keep standards? First, how to get a standard? This is a hard question to answer, as a standard inch that can be proved to be standard against some other inch that varies from it, is hard to find; but presuming that the diameters could be satisfactorily arranged, the bearing surfaces of a thread gauge are to a plain cylindrical gauge nearly as two to one, so that the standards of screw gauges are difficult to obtain and preserve. I am thoroughly convinced that screw gauges, to be interchanged, must be manufactured to one common standard, by which they must be adjusted. Some of the manufacturers are now having sets of gauges constructed on this principle, and hope to attain the best possible results, but the expense of these gauges will keep them from general use. A set of standard taps might be furnished from them and working gauges constructed at a nominal cost.

The question, How to keep the standard after once attaining it, presents itself. That it will go very much against the grain of most mechanics to throw away a good working tap because it is worn undersize, we admit. I believe, however, that any shop pretending to work to a screw standard of any sort, should be provided with hardened male gauges, and keep close watch of the nuts and other holes tapped, and let these tapped holes form the gauges, fitting the bolts to them. I am informed that this is the practice of some bolt manufactories. I have seen quantities of nuts tapped and bolts cut so uniform that they were assembled in the shipping room forming good fits. I believe this is practical, and gives a much more desirable result than to make the bolts in lots of a thousand and not expect the different lots to interchange, as is the practice in some shops.

The manufacturers are making an effort to furnish accurate tools in this line, which are to be an important help to the best attainable results.

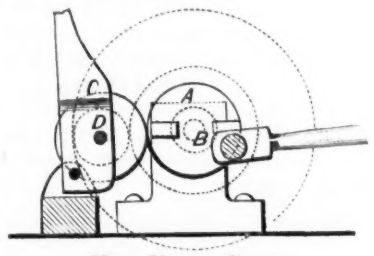
The progress of the Franklin Institute Standard has been retarded by the want of proper tools in the market. There has been a want of co-operation among the mechanics, and no central organization, such as this association is calculated to furnish, where not only the general and vital principles of our profession may be improved, but the minor details of this character may be so generally adopted that American machinery, by its uniformity of best design and construction, may be entitled to the most favorable consideration of foreign as well as home markets, and the field of our usefulness and profits correspondingly increased.

DISCUSSION.

Mr. Sellers expressed his thanks to Mr. Stetson for the paper he had read. He said that there should be uniformity in the diameter as well as in the number of threads. Mr. Stetson and other gentlemen who had gone into the manufacture of taps and dies were doing a great deal of good in this direction.

Mr. Porter said that it had been admitted to him very distinctly by the superintendent of Mr. Whitworth's works in Manchester, that the Whitworth system was defective; that the 12 threads to an inch was a mistake, and that the bolt was unncessarily weakened by the coarse thread. In respect to the angle, it had always been a great wonder how the angle of 55° came into existence. It could not be bisected, and it could not be verified without great difficulty. It had finally turned out, however, that it was originated by Mr. Whitworth, with the view of keeping the business of supplying the world in his own hands.

Prof. Sweet said: It seems to me that if such firms as Pratt & Whitney and the Morse Twist Drill Company, when we send to them for a set of ¼ taps, instead of sending us a set of sharp threads, knowing well that we have always advocated the adoption of the U. S. Standard, would send us the U. S. Standard, and send it to all, in fact, who are not particular about what they get, the matter would be improved. If these firms will send to those who order from them, and who are not particular which they have, the U. S. Standard, there will be a number of parties who will have the U. S. Standard without any complaint. The other day I sent an order for Pratt & Whitney's taps. It did not occur to me to say that the U. S. Standard was wanted, and when they came they were sharp threads.



NEW VALVE GEAR.

Mr. Sterling said that on the subject of screw threads, the two names of Whitworth and Sellers were about equally prominent, and it would be difficult to choose between the two. He noticed, however, one difference between the systems associated with the two names, and that was the sharp corners of the screw threads. It was universally known that a sharp corner in any piece of machinery was very objectionable. He thought this point should be considered in reference to screw threads.

Mr. Forney thought that if there was any department of mechanical engineering in which a system of standard threads was desirable it was in railroad car construction. In one case which had come to his notice, a railroad company specified for a large number of cars, stipulating that the bolts and nuts should be cut on the Franklin Institute Standard. The railroad company bought their taps and dies from one manufacturing firm. After the cars were delivered on the road, it was found that the bolts and nuts cut by the railroad company's taps and dies would not interchange with the bolts and nuts cut by the companies that built the cars. What was needed was an easy way of determining whether the taps and dies all corresponded to the sizes they were supposed to represent, and if the tap and die manufacturers would provide some easy method, which would not involve the expenditure of large sums of money for gauges, they would facilitate the introduction of this system very largely all over the country. The difficulty was first in determining the diameter; second, the angle of the thread, and, third, the pitch.

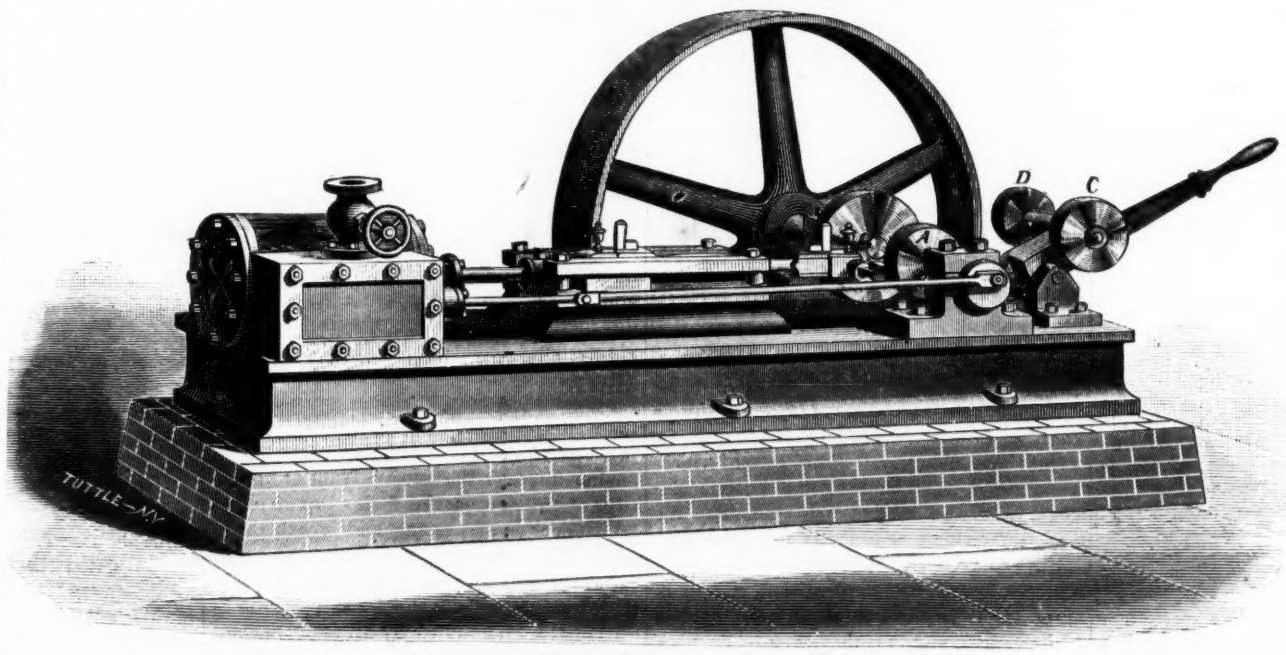
Mr. Stetson said: In regard to Prof. Sweet's criticism, he acts on the principle in regard to taps and dies, that other people know as much as he does. Perhaps eighty per cent. of the taps and dies which we [The Morse Twist Drill and Machine Co.], sell are sharp threaded, and if we should fill orders with the flat top and bottom, you can imagine the number of letters we should receive requesting us to send proper tools when we were ordered, and not those flat top and bottom things. The ignorance of people in regard to this is extraordinary. Some people change the 12 to 13, and think they have the whole United States system. Our guages are measured in thousandths. It is a pretty fine business, but as a good many people depend for getting fits upon the fish oil, which is a little gummy, we can work up to that standard quite easily.

Mr. Porter said that English cylindrical guages, accurate to the ten-thousandth of an inch, could be obtained by any body at any time, and were always exactly the same size. The only possible way of obtaining a permanent size was to have original guages, which were never used except to verify standards; the guages used in the work to be tested by the standards, the standards by the originals, and the originals never to be used at all except for that purpose.

A member remarked that a great deal of the trouble was in the leading screw of the lathe.

Mr. Darling had invented a contrivance for correcting the leading screw. He would like to know if any one had anything to say on that subject.

Mr. Sellers said that the best threads in the country were only an approximation to correctness. He knew of no true thread. The best way, perhaps, to correct a thread was to cause the nut to vibrate back and forth following a curved line. Some leading screws were cut very carelessly, while others were near enough right to answer all practical purposes. It was safe to say that the leading screws of most of the first-class makers of lathes would compare very favorably with one another.



JOSSERAND'S VALVE GEAR ON A STEAM ENGINE.

Josserand's Improved Valve Gear.

The object of the novel improvement in the valve gear for steam engines, represented in the accompanying engravings, is to admit of reversing the valve while the engine is either in motion or at rest.

The construction and operation of this device is as follows: The crank shaft of an engine is provided with the ordinary crank disc *B*, having an elongated crank pin passing through the pitway and beyond the brasses. A short shaft placed parallel with the engine shaft has a small disc crank, or eccentric, for working the valve attached to one end, while another larger disc *A*, having two lugs or projections diametrically opposite each other, is attached to the other end. A continuous rotary motion is communicated to the disc *A*, by the crank pin engaging one of the lugs.

When the engine is not in motion the valve can be reversed by simply turning the disc *A*, so that the opposite lug will engage the crank pin, and when steam is turned on the engine will move in the opposite direction. When it becomes necessary to reverse the engine while in motion, an appliance is provided, consisting of a shaft and lever attached to the engine bed, and carrying the friction wheels *C* and *D*. By pressing the handle of the lever so as to bring the friction wheels *C* and *D*, in contact with the discs *A* and *B*, motion is communicated to the disc *A*. Owing to the difference in the diameters of the friction wheels *C* and *D*, the disc *A*, is compelled to move ahead much faster than its maximum speed, until it is stopped by the opposite lug engaging the crank pin, when the engine will start off in the reverse direction. When a common crank is used instead of the disc *B*, and projecting pin, a block may be bolted to the crank so as to engage the projections upon the disc *A*, which are made adjustable, so as to regulate the lead of the valve.

This device is the invention of Peter Josserand, Hockley, Texas.

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Completion of Our Third Year.

In the early portion of our progress, as a mechanical newspaper, each successive issue going forth, as they did, with intervals of a month, marked an important era in the history of the AMERICAN MACHINIST. When, with our twentieth issue the paper was changed to a weekly, its development in circulation and influence—never slow—went forward with an impetus that surprised our friends, who, at the outset, shook their heads and energetically pointed out a very hard road before us, traveling as we were, in the face of firmly-established opposition. Our success, in short, has been a surprise to everybody interested in mechanical matters—except ourselves. Confidently believing that a strictly independent, fearless, and well-conducted machinery journal would not lack appreciation, it gives us pleasure to mention that the result has fully borne out our expectations.

Often a modest beginning upon a broad and substantial foundation has led on to signal triumph in a remarkably short period. As an instance, by way of digression, we may refer to the high position already achieved by the American Society of Mechanical Engineers, which was started only nine months ago by an informal meeting of leading engineers in the office of the AMERICAN MACHINIST.

With this issue we pass our third mile post, our initial number having been published in the middle of November, 1877. A considerable number of those who accorded their patronage to the enterprise at the outset are still counted with us, while the number has been gradually enlarging during these three years. It is hardly necessary to outline our plans for the future. Suffice it that it is our determination to continue to improve wherever experience shows improvement is desirable.

The new volume (Vol. IV.) will begin with the fifth issue after this, bearing date January 1, 1881.

A Prominent Industry.

A prominent industry of the American people is the discovery of new ways for doing old things; and ways of doing things that, when done, are of no value to any one except the discoverer, who speedily loses his interest when he finds that no one else has any in the alleged achievement. We sometimes think that many ingenious persons in this country commence by inventing a difficulty, or pretending that a certain want exists in the community for certain contrivances, and that they then set to work to "invent" something to stop popular clamor on the subject. Upon no other ground can we account for the invention of apparatus for tying shoe strings, a mechanical nose-blower, or patent support to prevent roosters' tails from becoming soiled, these being in no sense more absurd than bona-fide inventions issued from the Patent Office.

Before us, for example, is a patented churn with a steam engine attached; there is nothing new about the churn or about the engine, nor anything valuable about either combined; but they are patented, and, sealed with this distinction, will go forth to the country fair as the latest "invention in their line."

Now, if the inventor was determined to make a steam churn, why did he not turn the cream right into the steam cylinder, and thus dispense with the churn and dasher altogether? Then the steam would have agitated the cream, and the cream would have lubricated the steam; the butter milk could have been blown out through the waste cocks, and the butter itself used to lubricate the engine, all "substantially as set forth" and described. This would have been a novel and suprising machine, which is more than we can say of the subject of the patent.

Another example is the marine velocipede. For the want of marine velocipedes several families in every village in the country are suffering great distress, but they need not languish longer, for here is the machine all ready to be manufactured. The specification (accompanied by an engraving) shows a long narrow canoe with a bicycle mounted in the center of it; a belt from the large wheel drives a pair of bevel gears, which in turn drive a small propeller wheel of the usual pattern. But perched away on the top of this contrivance the navigator must sit—a weight of 150 pounds, more or less—five feet above the center of gravity of such a stable thing as a canoe! No circus should be without this invention. Here again is the velocipede driven by a spring, which is attached to the hind axle like any barrel spring, and which is expected to drive the machine and carry the man for a greater or less length of time—chiefly less. In order to get power out of any device it must first be put into it from some source, and the rider of this machine will find that the cheapest contract he can make with himself for power is to throw away the spring and traps thereto attached and foot it in the usual manner.

What we ridicule and discourage in this connection is the production of useless inventions that supply no want, and neither advance the arts or the fortunes of those who devise them. The cheapening of any staple, the more rapid production of food products, or wearing apparel, the lessening of labor, or improved modes of communication, are legitimate fields of effort, but catching at an idea and assuming that it is valuable, because the catcher never heard of it before, is a waste of time and money.

The Locomotive a Precedent for High Piston Speed.

Advocates of high piston speed, just now attracting some discussion and exchange of opinions, have a strong argument on their side in the locomotive as built and operated to-day. Certainly, no more prominent instance could be cited in favor of the system. Here is a machine that depends upon high speeds of piston for its success, and is worked under more adverse and destructive conditions than a stationary engine is ever liable to, yet it undergoes no extraordinary wear and tear while exerting far greater power in the same space of time than the stationary engine. As regards mechanical construction, the locomotive engine displays the most advanced knowledge of the day, in the fitting up of parts, in proportion of bearing and wearing surfaces, and in working steam expansively, as far as the link motion is capable, while in mere endurance of shock and strain of varying loads, handled by different persons of more or less mechanical knowledge, it suffers more in a year than a stationary engine in a lifetime.

No other tools than those already in daily use are required; no mechanics, other than those already trained, need training, so that, if we are to build high speed stationary engines instead of low speed, the necessary appliances and precedents exist. In connection with this subject, and as a practical example of the truth of the statements above, engine 273 on the Pennsylvania Railway may be cited. This engine was built in 1875, has five-foot drivers, and weighs about thirty-eight tons. It has never been repaired until recently, two months ago, and in forty-nine months' continual use has made a mileage of 251,552. This is only one instance, but doubtless many more could be cited in favor of the practicability of economical high piston speed.

English journals are full of the recent performances of the Livadia, the new steam yacht built for the Czar of Russia. They cannot get over the surprise occasioned by her making 16 knots on her trial trip. As we mentioned in a recent number of the AMERICAN MACHINIST, this vessel is not unlike an East River ferry-boat in her model, being very wide in proportion to her length, so that she is enabled to carry *thirteen thousand horse power*, or very nearly three times the power of the largest ocean steamers afloat. There is nothing to wonder at in her speed, except that she is rather slow than otherwise, for any marine structure, be it a floating bethel, a dry-dock, or a landing stage, that can carry thirteen thousand horse power, ought to do at least 16 knots, and with a good model very much more.

Her recent trial in heavy weather in the Bay of Biscay showed that she is not fitted to encounter heavy seas, for although she was not boarded, the enormous lifting power of her wide bows caused her to rise readily and fall heavily, so that she sprung some of the plates forward and leaked. The dimensions of the Livadia preclude the possibility of docking her, so the only way she can be repaired is to beach her, or list her, so the plates injured can be got at.

Machine tool builders, especially, will find food for reflection in Mr. Charles T. Porter's paper published in another column, as read before the American Society of Mechanical Engineers. Strength or firmness in such tools, while it is a quality that may be overdone, is a quality in which tools should not be deficient from either the artistic or practical point of view.

Hardening the journals of lathe spindles and leaving the rest of them soft has proven so expensive a job to some manufacturers that they have been compelled to abandon the undertaking. It seems to us that this should not be so difficult. Dies of drop presses—up to 200 pounds weight—are hardened on their faces only without loss; this is on one side of a large mass of steel, whose shrinkage and other changes of structure have to be accounted for. It would seem as though a lathe spindle should be susceptible of hardening without loss—if the hardener knows how to do it.

With this issue we publish the conclusion of President Thurston's inaugural address before the mechanical engineers. The sentiments therein expressed, if published by the society in pamphlet form (as probably will be done) for general distribution, would form an excellent platform for the consideration of persons interested as probable, or possible, applicants for admission to the new organization.

An interesting point in the discussion on Mr. Sellers' paper before the Engineers' Society, combating the enforced introduction by law of the Metric System into machine shops, was reached when Mr. Worthington stated the difficulties which middle-aged men would experience in memorizing the designations and tables involved. His regret that he had not been taught the multiplication table up to 24 times 24 in his youth, because now he could not command his memory to the required extent, opened a line of thought capable of wider application than such a discussion could admit of. The young men of our day have many advantages over their elders in the way of gaining mechanical knowledge in advance of the emergencies that put knowledge to practical use, and not the least of these advantages is found in the purely mental training, to which they can accustom themselves, if they will, and which the old-time engineers had to reach from the practical end, if they reached it at all.

No feature of the recent meeting of the American Society of Mechanical Engineers was more pleasant than the marked attention of members to the speaker of the moment. An unflagging interest was manifested whatever the topic, and all seemed to feel that the occasion was one of profit, as it most unquestionably was. No man conversed with his neighbor on trivial matters, but took in the teachings of experience as they fell. These meetings will be of great value to the interests of the country at large.

In addition to large ocean steamships recently mentioned in the AMERICAN MACHINIST as building in Europe, the Cunard Line have contracted for three, one of which is to be of steel, 7,000 tons burthen

and 8,500 H. P.; the others are of 5,000 tons and 4,500 H. P. The coming year will witness the advent of greater improvements in ocean steam vessels than ever before known, notably in speed and economy of maintenance.

Death in the Electric Lamp.

It seems as though great improvements in the way of lighting are attended with peril to life, whatever the medium employed. Kerosene numbers its victims by thousands, and the light of the future—electricity—has already caused the loss of two lives abroad by careless handling. In Manchester, England, a person inadvertantly touched the exposed connections and diverted the current through his body. On the Livadia a similar accident occurred to a sailor who was hanging an electric light in the fire-room. He grasped a brass rod which runs around it and at the same time allowed one of the connecting wires to swing against his body, thus sending the powerful current through it with instantaneous death as the result. With the rapid increase of electric lights in this country, the above record will show that they should not be handled by the inexperienced.

Literary Notes.

THE THEORY AND ACTION OF THE STEAM ENGINE FOR PRACTICAL MEN.—By W. H. Northcott, C. E., 175 pp., 8 vo., cloth; price $3.50. Published by Cassell, Petter & Galpin, London, Paris and New York.

The author in writing this book has evidently carried out the ideas suggested by the title, in producing a treatise adapted to the wants of the practical man who has not had the advantages of a university education. The book is written with a fair degree of precision and yet intelligible to the non-mathematical student and general reader. In avoiding intricate formula the author has introduced valuable tables, by means of which most of the questions pertaining to the steam engine may be solved. The student is supposed to be familiar with the first four rules of arithmetic. Each subject treated of is classified under its particular head, and treated in the form of question and answer. The work done by engines is represented by appropriate diagrams.

A very interesting description of the theory and action of the compound engine is presented and illustrated by diagrams taken under different circumstances. The student is instructed how to proceed in the details of testing a steam engine so as to get reliable results. On page 147 is given a reliable method of laying out the points in the adiabatic curve without the use of intricate formula. The appendix contains some of the most practical rules and tables for the use of engineers. This book has been adopted as a text book at the U.S. Naval Academy, and we cordially commend it to our readers.

Questions and Answers.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1.) W. J., Fishkill, N.Y., writes: I have two boilers and they foam very badly, so much so that the water rushes through the steam pipe into the cylinder. We found considerable mud and sediment in the cylinder, and had done some damage. In order to overcome the difficulty I propose to put a tank or receiver between the engine and boilers, which I think will give me dry steam and catch all the dirt and water. *A.*—Your boilers foam which is an indication that something is wrong; we therefore advise you to ascertain the cause and endeavor to prevent it. It is not a wise course to apply a receiver, as proposed, as it will not help you in obtaining dry steam. If you had given us the dimensions of your boilers, together with a description of the settings, also the size and number of revolutions of your engine, we might help you out of your difficulty. We cannot direct you until you send us the information desired, giving your full name.

(2.) J. F. A., Martinsburg, Pa., writes: I am thinking of going into pulverized lime business, and I would like to know what a crusher and pulverizer with a capacity of 5 and 10 tons will cost? Also the best make of crushers and pulverizers, suitable for crushing and pulverizing hard limestone for fertilizing purposes? also the prices and the size of engine and boiler it will take to run a 5 and 10 ton crusher, etc? And I want to know if there is any gearing required between the crusher and engine, or do you make direct connection from the engine to crusher and pulverizer? *A.*—We cannot inform you in relation to the price you will have to pay for the machinery desired. The information in regard to the best crusher can only be obtained by actual experiment and from those who have used all kinds in practice, and furnish an impartial report of the performance of the same. The power required to drive a well-made crusher of the capacity mentioned may be derived from an engine having a 5″x7½″ cylinder, developing about 6-horse power. The crusher alone, under ordinary circumstances, will probably require about two horse power. You may use a direct belt connection from the engine to the crusher. The remaining information desired may be obtained from the parties from whom you intend to purchase your engine.

(3.) H. J. B., Chicago, Ill., asks: Will you please answer the following questions: 1. How find the heating surface of locomotive boilers? *A.*—We take it that your question refers to the method of procedure to find the heating surface of a boiler already constructed, and will so answer it. Measure the inside of the fire box as follows: The sides, crown sheet and both ends, deducting the area of the fire door and the area of the tubes. Find the number of square inches of surface upon the inside of one tube by multiplying the circumference by the length, the product multiplied by the number of tubes will give the total heating surface in the tubes. Ascertain the area of the front boiler head and deduct the area of the tubes. Add all the results previously found together, which will give the total heating surface. All the measurements should be taken in inches, so that by dividing the final results by 12 will give the total square feet of heating surface. 2. What is the amount of heating surface allowed per horse power? *A.*—On locomotive boilers from 15 to 17 square feet of heating surface is allowed per H.P., depending upon the kind of work and fuel to be used. 3. How many cubic feet of boiler space should be allowed per horse power. *A.*—A safe, practical rule is to allow one cubic foot of water per H.P. per hour, and one cubic yard boiler capacity. This is ample for the ordinary slide valve engine, and will furnish a surplus for an engine having automatic cut-off. 4. Give a rule for finding the heating surface per horse power for horizontal tubular boilers? *A.*—The horse power of boilers is the subject that has been much discussed by many authorities who differ somewhat in their decisions, but there is an old rule of thumb which has been demonstrated in practice, which is more generally used than any other. For tubular boilers 15 square feet of heating surface is allowed per H.P. The cubic feet of boiler capacity per H.P. is the same as that previously given.

Business Specials.

50 cts. a line for each insertion under this head.

Jenkins' Patent Gauge Cocks, the best in use. Send to A. W. Cadman & Co., Pittsburgh, Pa., for illustrated circular.

Latest and best books on Steam Engineering. Send stamp for Catalogue. F. Keppy, Bridgeport, Ct.

Howard S. Abbot, Attorney at Law and Solicitor of Patents, 617 7th Street, N. W., Washington, D. C. Personal attention given to cases in Patent Office.

Sheet Metal Presses. Ferracute Co., Bridgeton, N.J.

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See Standard Turbine advertisement in last issue.

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Paper Making Machinery—Makers of above from fibrous material as wood, esparto grass, etc., send address to Joshua Rose, P. O. Box 3306, N. Y. City.

Rules for Engineers, and Removal of Scale in Boilers. Send for Circular. Ranken Scale Co., 50 Federal Street, Boston.

Manual of Power for Machines, Shafts, and Belts, with the History of Cotton Manufacture in the United States, by Samuel Webber, C. E., copyrighted 1879. Only work of the kind extant; 240 pages. Price $3. Address, the author, Manchester, N. H.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

MANUFACTURES.

James Jenks, of Detroit, has patented, and is now putting on the market, a new injector—so far with complete success.

The Billings & Spencer Company, Hartford, Conn., write us: "We are full of orders, all we can do for the next eight months. Just put on 30x50 feet to our forging shop and we propose putting in more drops as soon as possible."

According to *The Textile Record*, new mills have lately been erected in Philadelphia, as follows:

Beswick & Kay 50x150 feet; Boggs & White, carpet mill, 50x75 feet, six floors; Campbell & Elliott, 12th and Washington Sts., 50x160 feet, four stories; P. & C. Collins, 1314 Lawrence St., 50x150 feet, five floors; Alex. Crow & Son, carpet mill, 45x180 feet, four stories; Rob't Dixon & Co., cotton mill, on Canal St., 5,000 spindles and carding machinery; John & James Dobson, Falls of Schuylkill; Horner Bros., 4th and Lehigh Aves., group of mills, area of 500x200 feet, main building 6 stories; Leech & Bro., Manayunk; John Williams & Sons, 12th and Carpenter Sts., 50x200 feet, five stories; Wm. Wood & Co., 22d and Spring Garden Sts., an extensive group of mills; John Yewdell 25th and Callowhill Sts.; James Smyth & Co., Pine St., Frankford; John Davenport is building a large silk mill at Hancock and Somerset Sts., and W. A. Griswold & Co. are erecting a large silk mill at Darby.

The Chicago Car Axle Co,, South Chicago, are building an addition of 120x50 feet to their steam forge works, and adding new furnaces and machinery.

The movement for the establishment of a large plow factory in Elgin, Ill., is meeting with considerable success. The committee appointed for the purpose of raising funds report the prospect very good.—*Chicago Industrial World.*

The Dixon Crucible Co., Jersey City, are building an addition to their works, to be devoted to manufacture of axle grease and stove polish. It is 50x50 and four stories.

The new rag engine washer invented by John Tyler, of Claremont, N. H., is attracting considerable attention from paper manufacturers. This washer is so constructed that it may be regulated on washer or hydrant. It has copper buckets and iron heads, and no wood is employed in its construction, except the core and sash, the latter being fastened to the head with brass screws. The manufacturers who now use it say it washes an engine one hour sooner than any other washer they ever tried.—*Paper World.*

F. F. Hemenway is now building a 130 H. P. automatic cut-off engine of his own designing at the Starbuck Iron Works, Troy, N.Y., for Bussey, McLeod & Co. of that city. He also has contracts for two engines of 100 H. P. each of the same style. The engine is one recently brought out, and will probably be the subject of an illustrated article in the AMERICAN MACHINIST at no distant date.

The Betts Machine Co., Wilmington, Del., report great activity in their gauge department. This includes their measuring machines, standard gauges, adjustable reamers, etc. Those already supplied, or at present ordering, comprise many of the largest concerns in this and other countries, besides a number of extensive railroad shops. Their sales in this department this year, they say, will be more than three times greater than in 1878, and they feel encouraged at this evident appreciation of accurate measurement in machine fitting.

The North-Western Pin Factory, which began operations at Bay City, Mich., about a year ago, has collapsed, and all the pin machinery sold and taken to Waterbury, Conn. The premises has been secured by Messrs. Barber, Forbush & Stevenson, who will carry on a general machine shop business, with model making and small work a specialty.

The White Sewing Machine Co., of Cleveland, Ohio, started their new two hundred horse-power engine October 25. They are rapidly getting their machinery into the new addition, and expect very soon to double their present production.

Newly Incorporated New York Companies

The Harlem Manufacturing Company, New York and Brooklyn: Capital, $10,000, in shares of $10 each. For the manufacture and sale of sewing machine attachments, electric instruments, etc., October 28th.

The Great Eastern Hydro-Fuel Company, New York: Capital, $5,000,000, in shares of $100 each. For the manufacture and sale of furnaces, steam generators and other apparatus in which is burned Hydro-Carbon fuel. October 28th.

The Great Western Hydro-Fuel Company, New York: Capital, $2,000,000, in shares of $100 each. For the manufacture and sale of furnaces, steam generators and other apparatus in which is burned Hydro-Carbon fuel. October 28th.

Alpine Iron and Mining Company, Alpine, N. Y.: Capital, $50,000, in shares of $25 each. For the purpose of manufacturing chemical pig iron and mining iron ore. Oct. 29, 1880.

Anglo-American Roofing Company, New York: Capital, $1,000, in shares of $25 each. For the manufacture and sale of iron shingles. Oct. 30th.

The New York Extracting and Fertilizer Manufacturing Company, New York and Elizabeth, New Jersey: Capital, $30,000, in shares of $50 each. To manufacture and sell lard, tallow, grease, oils and fertilizing materials. Oct. 30th.

The Lea Mond Electroed Medical Parlor Bath Company, New York: Capital, $50,000, in shares of $50 each. For the manufacture and sale of Electroed Medical Bath Lounges. Oct. 30, 1880.

Automatic Car Coupling Company, New York and Boston: Wm. A. Martin, Edw'd K. Parker and others, trustees. Capital, $500,000, in shares of $25 each. For the manufacture and sale of automatic car couplings and railroad cars, under Wm. P. Cutler patents. Filed Nov. 3, 1880.

The Henry H. Fleischman Manufacturing Co., New York and Brooklyn. Henry H. Fleischman, Myer Dittenhoefer and Morris Levy, incorporators. Capital $30,000, in shares of $100 each. For the manufacture and sale of vinegar and yeast, and of all products that are produced in the manufacture thereof. Filed Nov. 3rd, 1880.

The Tonawanda Valley Extension Railroad Co.: Capital $120,000, in shares of $100 each. Directors, Richard G. Taylor and Wilson S. Bissell of Buffalo; R. H. Farnham, R. S. Stevens, C. S. Thompson, J. H. Loomis, Levi R. Vincent and Jno. V. D. Loomis, of Attica; G. R. Blanchard, B. W. Spencer, J. D. Fish and E. S. Bowen, of New York City, and General C. Parker of Varysburgh. To construct, maintain and operate a railroad from the village of Curriers Corners, Wyoming County, to the village of Sardinia, Erie County, about eleven miles. Nov. 3rd, 1880.

The John J. Crooke Company, New York and Chicago, Ill. John J. Crook, John N. Goodwin, and others incorporators. Capital $500,000, in shares of $100 each. For the purpose of casting, rolling and pressing soft white metals into various manufactured articles, and disposing of the same. Filed Nov. 3rd, 1880.

Newly-Incorporated Massachusetts Companies.

The Hampden Glazed Paper and Card Company, Holyoke, Aaron Bagg, president; George F. Fowler, treasurer. Capital, $28,000, in shares of $100 each. For the manufacture of plain, glazed and colored papers and card board, the glazing, coloring, ornamenting and preparing in other ways paper and similar products, and dealing in the same. Nov. 3.

The Globe Worsted Mills, Lawrence, Frederick Butler, president; Thomas Clegg, treasurer. Capital, $30,000, in shares of $100 each. For the manufacture and sale of worsted yarn, woolen yarn and worsted fabrics. Nov. 8.

Machinists' and Engineers' Supplies.

NEW YORK, November 11, 1880.

A good fair business is being done in supplies this week, and there is every prospect of a satisfactory continuation.

Prices have changed very little.

C.W. LeCount, of South Norwalk, Conn., sends us a revised price-list containing descriptions and prices of his lathe dogs, clamps, mandrils, etc.

Strasse & Co., 62 Chatham Street, New York, have just issued a new and reduced price list on the Elterich taps, dies, wrenches, etc. The reduction is a little less than one-third.

James Beggs & Co., 8 Dey Street, have taken the sole Eastern Agency for the Excelsior Boiler Tube Scraper, also the improved Gardner Governor.

Iron Review.

NEW YORK, November 11, 1880.

Pig iron has advanced $1 to $1.50 a ton on American brands and fully $1.50 on Scotch. No. 1 Foundry Iron sells at $25 to $26 and No. 2, $21 to $21.50. The much higher relative price of No. 1 is caused by its comparative scarcity in market. There is a good demand. Old rails are $1.50 a ton higher. Old T rails sell at $27 and double heads at $28.50 a ton.

Manufactured iron also remains the same as last reported.

Carmichael & Emmens, 130 Cedar St., New York, quote prices of Boiler Makers' Supplies from store as follows:

Flange Iron	5¼
C. H., No. 1, Shell Iron	4¼
C. No. 1 Iron	4
Tank Iron	3¾
Sheet Iron	3½
Angle Iron	3½
Bead Iron	5½
Burden Boiler Rivets	5 1-10

Boiler Tubes at 40 per cent. discount off list.

Metal Review.

LUCIUS HART & CO., 8 & 10 Burling Slip, New York, furnish us the following, under date of Nov. 11, 1880:

A stronger feeling pervades the metal market, with a fair business doing. Pig Tin in London £91; and Singapore, $28. Would quote spot Banca Tin, 25c.; Malacca and Straits, 21c. to 21¼c; Australian and Billiton nominally 21c.; "Lamb & Flag," 21c; Lead steady at 5c. to 5¼c. for jobbing lots; Antimony, 14½c. for ordinary brands; 15½c. for Cookson; Spelter, 5¼c. for Domestic, and 8¼c., for "Bertha," pure; Solder, No. 1, 11½c.; "Half and Half," 13½c.; Bismuth, $2.50 to $3.00.

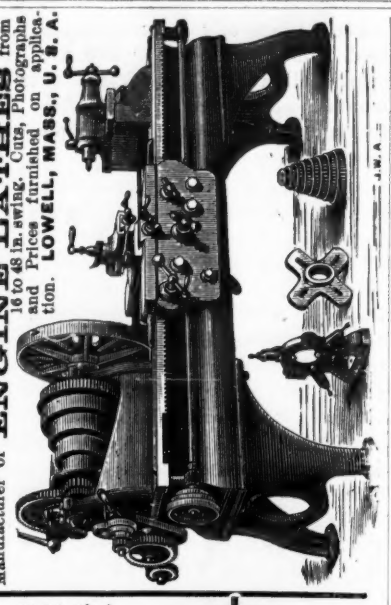
WANTED.

Parties desiring a competent man to superintend the erection of engines or machinery, address J. F. Kingsley, Box 777 Owego, Tioga Co., N. Y.

Wanted—Machinists—Six strictly first-class Vise hands and Fitters accustomed to building machine tools; liberal wages paid by Niles Tool Works, Hamilton, Ohio.

Wanted.—Four first-class salesmen well up on steam. Geo. S. Strong, care I. P. Morris Co., Philadelphia, Pa.

GEO. W. FIFIELD,
Manufacturer of ENGINE LATHES from 16 to 48 in. swing. Cuts, Photographs and Prices furnished on application. LOWELL, MASS., U. S. A.



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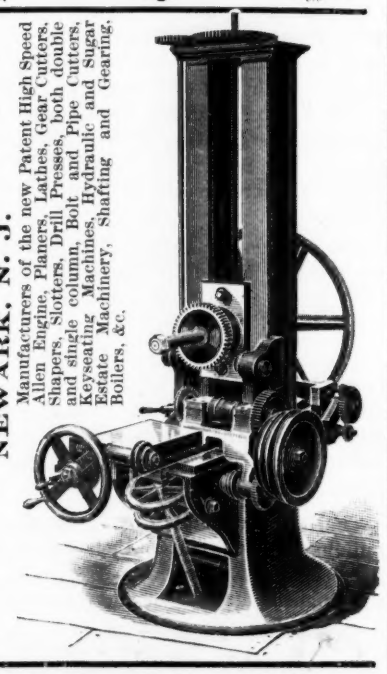
Manufacturers of the new Patent High Speed Allen Engine, Planers, Lathes, Gear Cutters, Shapers, Slotters, Drill Presses, both double and single column, Bolt and Pipe Cutters, Keyseating Machines, Hydraulic and Sugar Estate Machinery, Shafting and Gearing, Boilers, &c.



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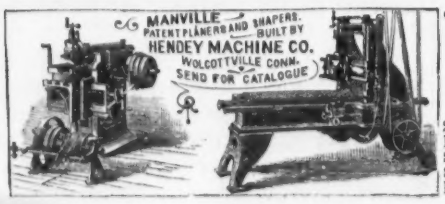

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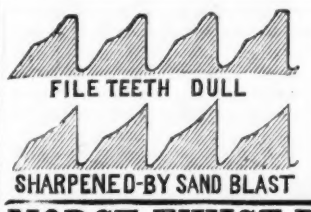

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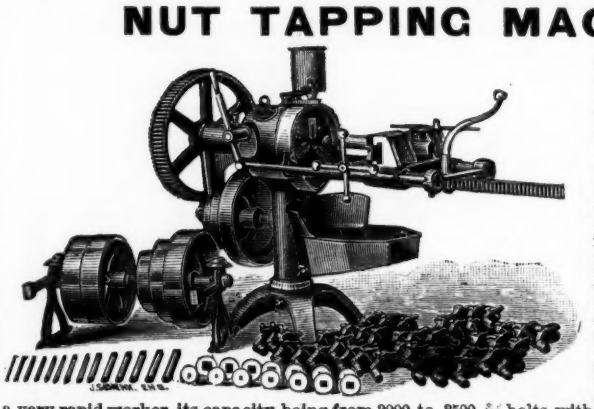

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Messrs. KEARNEY & FOOT, Elizabethport, N. J., July 9th, 1877.
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Messrs. KEARNEY & FOOT, Elizabethport, N. J., May 3rd, 1877.
Gentlemen:—We have been using your Files, both new and re-cut, for several years, and take pleasure in saying that we have found them a very superior article.
HANS REISE, Contractor, with The Singer M'f'g Co.
We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.
Respectfully, KEARNEY & FOOT.

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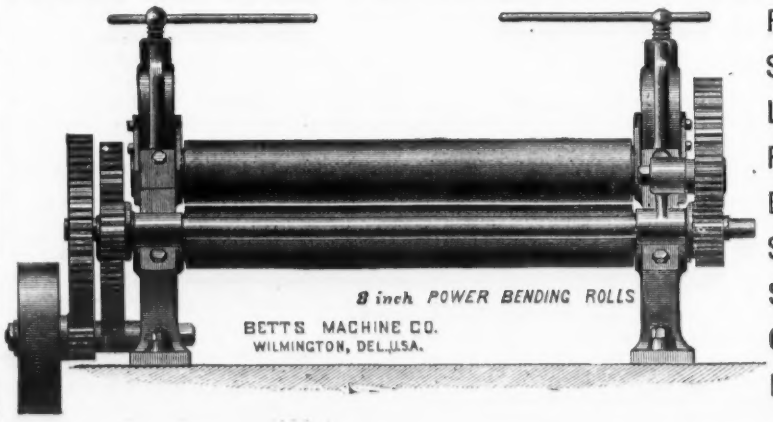

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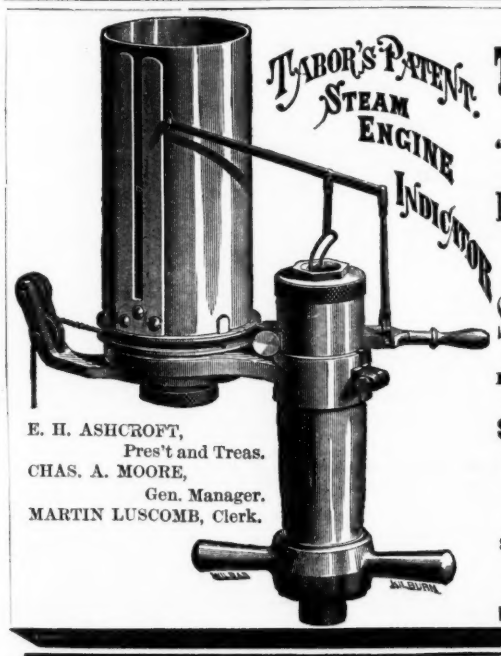

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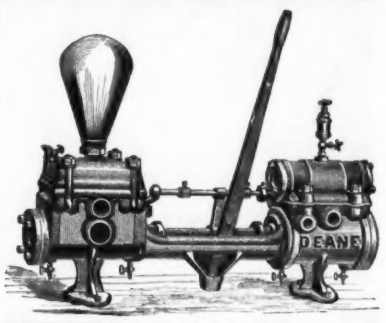

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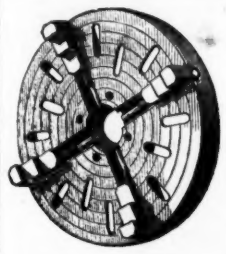

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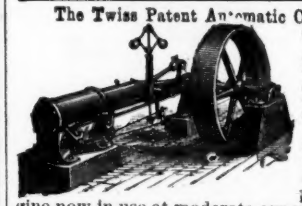

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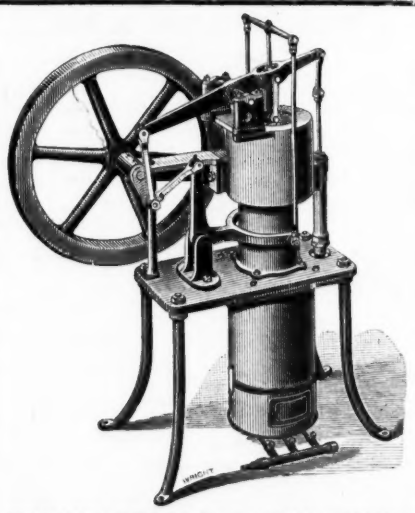

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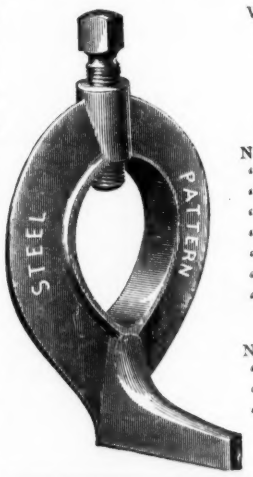

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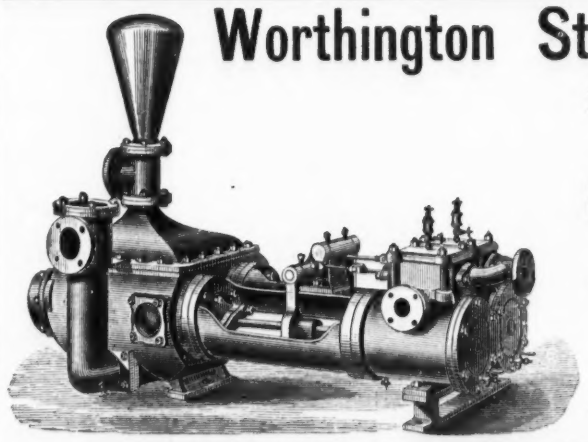

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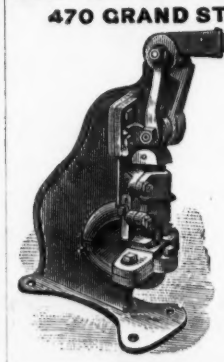

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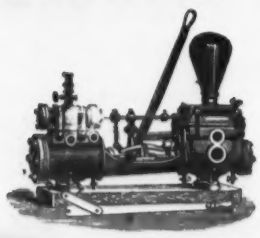

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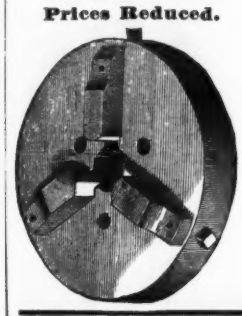

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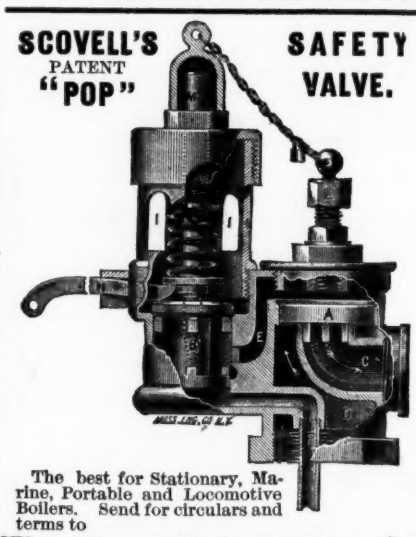

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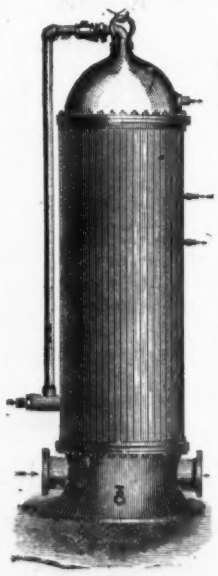

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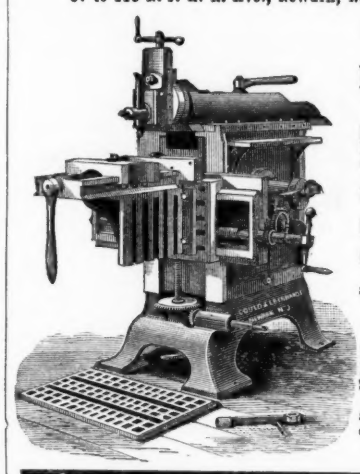

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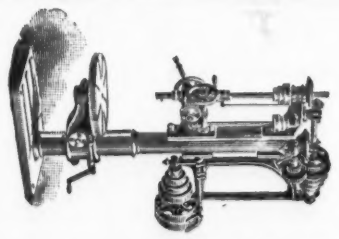

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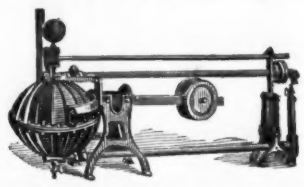

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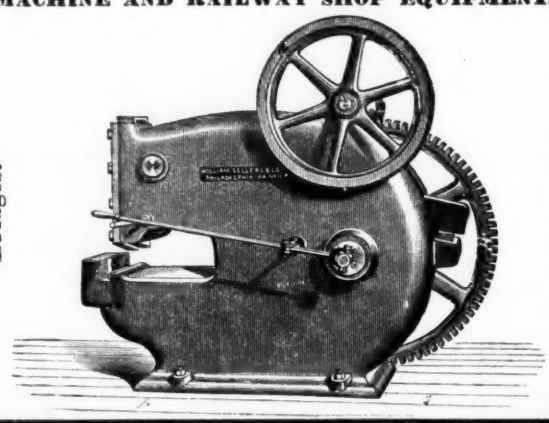

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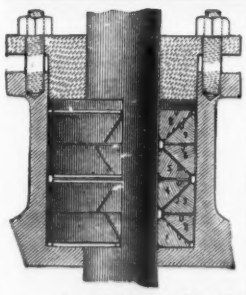

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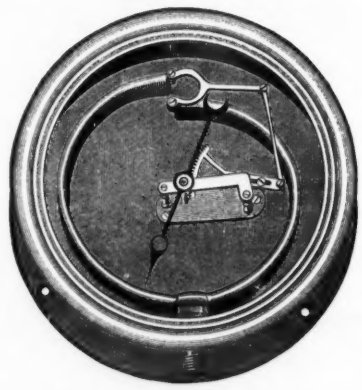

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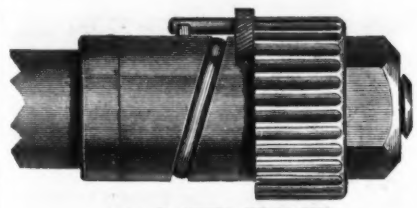

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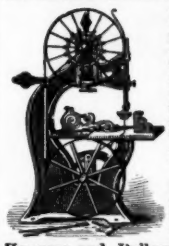

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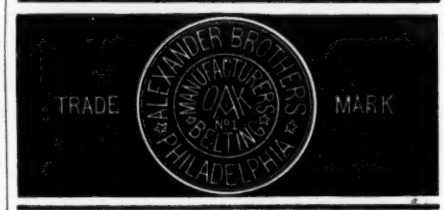

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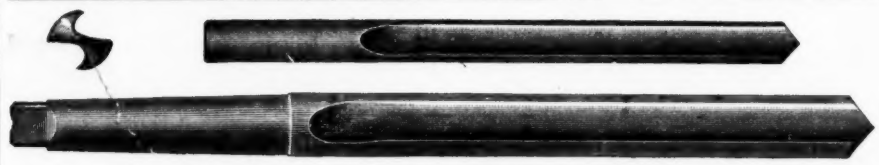

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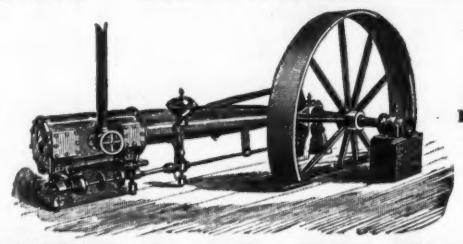

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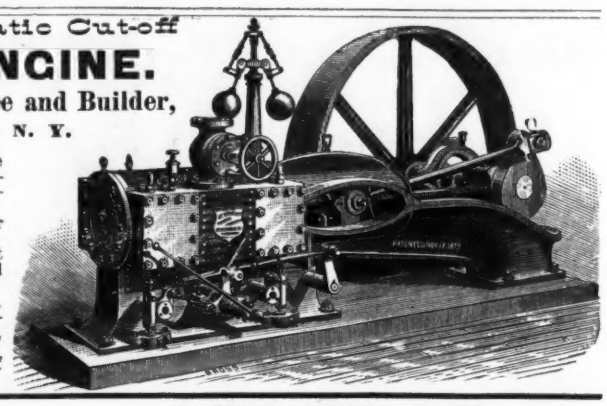

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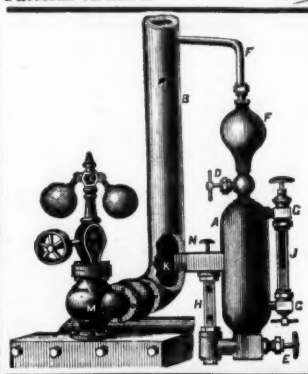

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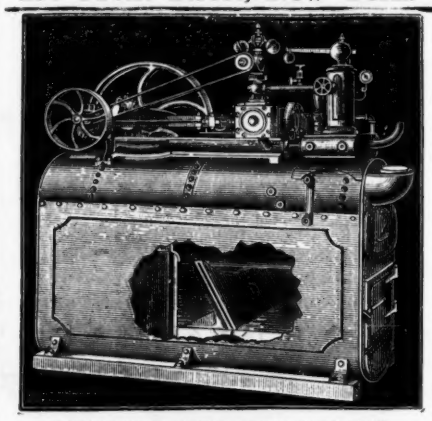

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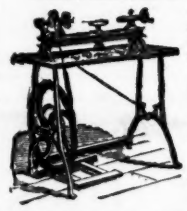

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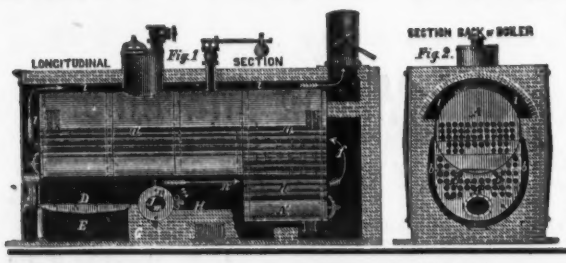

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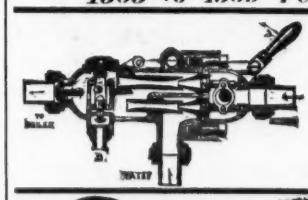

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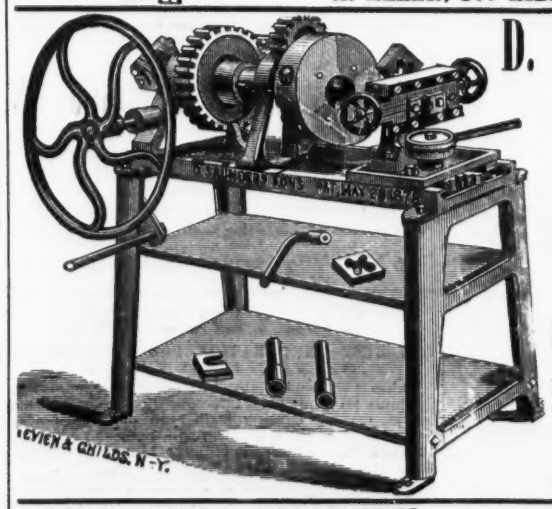

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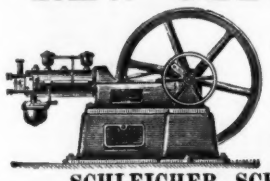

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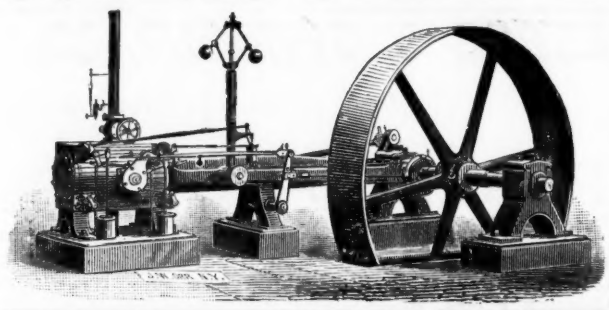

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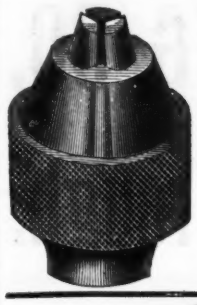

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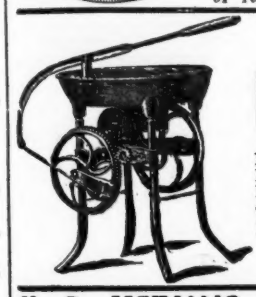

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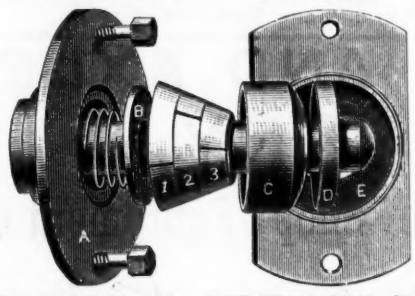

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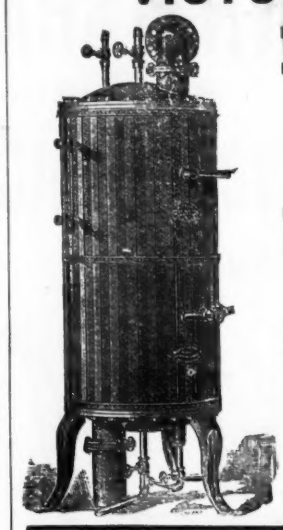

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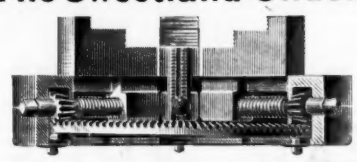

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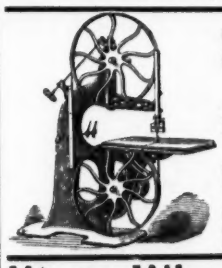

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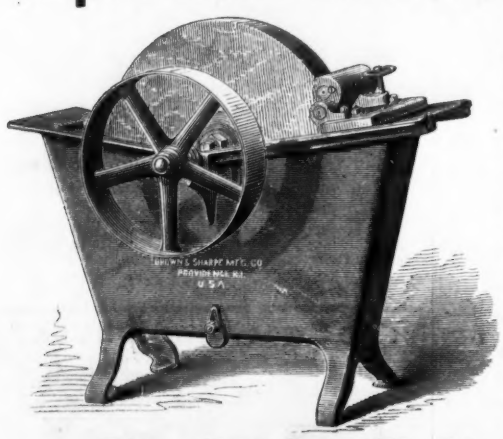

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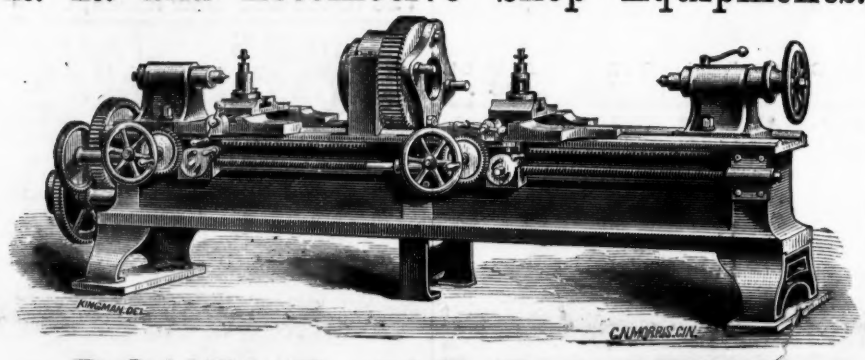

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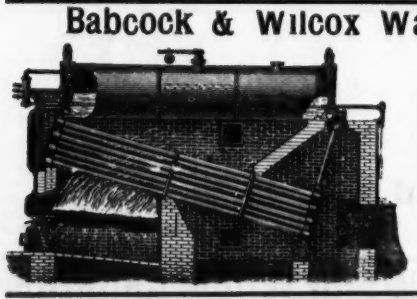

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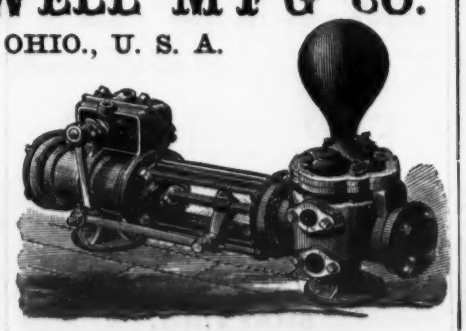

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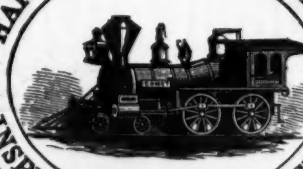

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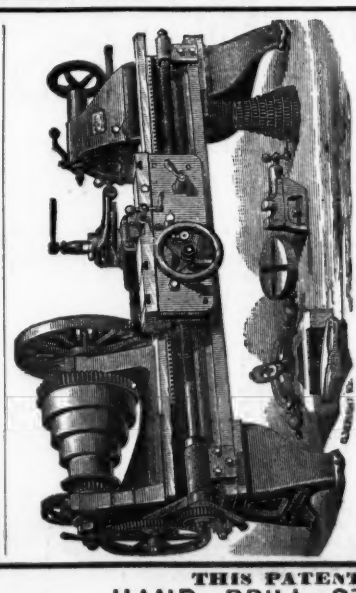

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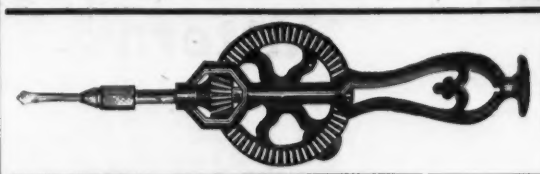

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